

HYDRO COMMENTS

INTRODUCTION

The following comments focus on the effects of the FCRPS on listed salmon stocks within the Columbia River Basin. The comments are set forth in three sections. The first addresses general criticisms with NMFS analytical approach. The second section addresses our concerns with the “Full Mitigation” concept in NMFS jeopardy standard and analysis. The third is a section by section review of chapter nine in the FCRPS BiOp.

I. COMMENTS ON NMFS’ OPTIMISTIC ANALYTICAL APPROACH

NMFS assessment of the impact of the Federal Columbia River Power System (FCRPS) on affected salmon stocks uses compounding optimistic assumptions. NMFS has chosen analytical techniques, input assumptions and performance standards that overestimate the apparent well-being of the stocks in question. This leads to an underestimate the level of improvement needed to recover affected salmon stocks. This has been a reoccurring problem since the stocks were listed. The comments of ODFW and IDFG address many of the optimistic assumptions of NMFS. The lack of openness and clarity in the CRI and related NMFS analysis that had been a feature of the previous, collaborative process (PATH) continues to be an unnecessary and disturbing problem.

A first level of optimism concerns the CRI analytical framework. The framework consists of a Dennis model and a Leslie Matrix model, although the latter has not been used to any great extent in the recent past. While NMFS’ framework is appropriate for estimating the probability of extinction (one of NMFS performance standards), it is not appropriate for assessing the feasibility of management actions to meet escapement goals, such as survival and recovery goals established by the BRWG and others or tribal subbasin rebuilding objectives. A principal reason why the framework is inadequate for assessing future management actions is that there is no density dependence and, absent such a damping mechanism, the modelled populations quickly increase to unrealistic levels. NMFS analysis of density dependence was based on the period after the hydrosystem was in place, a period with low spawning densities and virtually no chance of density dependence.

We are also concerned about NMFS selective use of input values for the analytical framework. See figure 1. A modified Dennis (1991) model is used to estimate Lambda, the population growth rate (lambdas greater than one denote a growing population; less than one a decreasing population). Although lambdas in the past were calculated using recruit per spawner data, where recruits are linked to the number of spawners that generated them roughly four and five years previously, the current methodology link recruits to the number of spawners the year before. This approach, first, makes no sense from the biological perspective and, second, produces substantial overestimates Lambda.

In absence of supporting evidence, the summary tables (e.g., 9.7-27) are calculated under the assumption that hatchery-reared fish reproduce with only 20% efficiency relative to naturally spawned fish. This assumption, if incorrect such that spawning efficiencies of hatchery fish are higher, e.g. 80% hatchery effectiveness, artificially inflates the probabilities of survival and recovery reported in the RPA. Until such time as empirical data are available to quantify the relative effectiveness of hatchery-reared

fish, we suggest that NMFS should use a range of probabilities for survival and recovery calculated at various levels of hatchery-reared spawner efficiency and that rejecting an 80% efficiency input value is inappropriate.

The time series of years chosen to estimate Lambda also yield high values of Lambda. Previously NMFS has hypothesized that 1980 represents the beginning of a new era for the hydrosystem, a point where the debris problems had been remedied. If so, the 1978 brood year would have been the first brood to have benefited from the new era, beginning in 1980. But NMFS began their analysis with the 1980 brood year, a choice that lacks a rationale and further raises the values of Lambda for the Snake River stocks. There is additional concern that the rate of decline is increasing (referred to as non-stationarity; Oosterhout 2000). This is a concern because the resulting lambda may mask an increasingly threatening situation that could, in fact, be evidence of a steepening decline known as an extinction vortex. Additionally, the assumed population increases through 2004 are dubious.

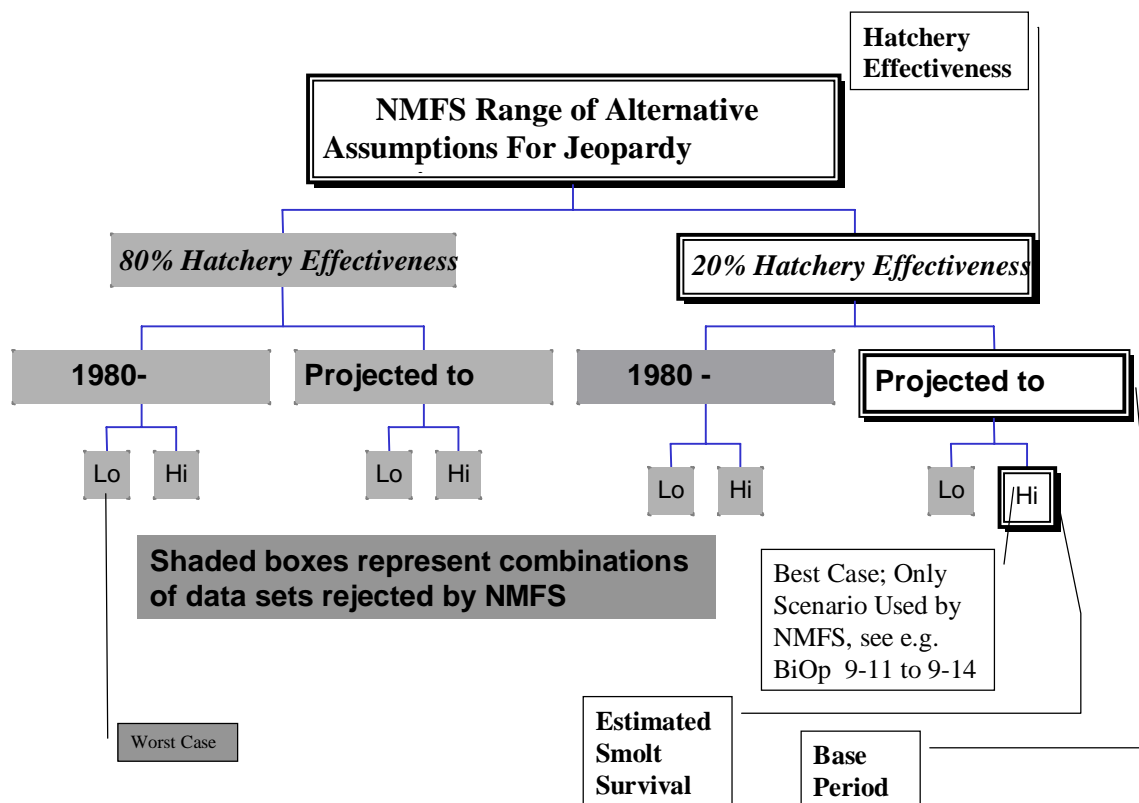


Figure 1. This figure depicts optimistic input values selected by NMFS for its jeopardy analysis and other more realistic values not considered by NMFS.

Not only is NMFS optimistic in their estimates of lambdas, they are also optimistic about the level of survival improvements attainable through management changes in the hydrosystem. Thus a combination of inflated lambdas and inflated expectations boost the lambdas over one (equilibrium).

While modest increases in survival are no doubt possible, NMFS is proposing values that appear to be unrealistically high. NMFS is also proposing that any additional increases would come from offsite mitigation. As noted elsewhere, such opportunities are limited and their effects would not manifest themselves for decades. Early in the CRI process NMFS called for feasibility analysis but it has not attempted to conduct one to date. A subset of former PATH scientists is currently conducting a feasibility analysis on the management actions proposed for Snake River spring chinook. The report will be made available to NMFS by October 27, 2000.

NMFS is particularly optimistic in matters of performance measures. There has been a shift in focus away from escapement based survival and recovery standards, and toward the probability of extinction. There is nothing wrong with such a standard but it is not as meaningful to the tribes as the standards based on projected escapements. More importantly, NMFS has chosen a standard that is the least risk adverse: the proposed NMFS standard is literally extinction (i.e. one fish or less in a generation.) Thus stocks that have experienced zero adult returns in some years, and would have met NMFS' old standard, would not meet the new one. According to this theory, a stock could have one fish return every other year and be in no danger of extinction. Realistically, the red lights should go off long before a stock is down to one fish and thus the probabilities associated with several levels of abundance should be presented. In choosing this most lenient standard, NMFS ignores its own scientists and a host of authorities on the subject. The sensitivity of the probability of extinction to different standards has been provided in comments from the USF&WS.

In lieu of feasibility analysis, NMFS proposes the development of performance standards to measure progress. Information needed to assess many potential standards would not be available within the indicated evaluation period (three to eight years). Any standard based on lambdas would be inherently insensitive to change because of the five year averaging period for the running sums as well as the lag. In addition, lambdas may a risky way to evaluate stocks at low population levels. Miscalculations are possible due to the aforementioned methodologies employed or because of measurement error. Lambda, by itself, is a crude measurement tool, and should be used in conjunction with more robust measures such as actual escapement or SARs.

II. THE "FULL MITIGATION" CONCEPT IS FLAWED

A. NMFS' Reach survival data does not address population status as affected by the hydrosystem.

1. NMFS' Reach survival data does not address population effects that will linger for decades.

NMFS' analysis of the effects of the hydrosystem upon stocks of salmon, with regard to full mitigation, fails to take into account substantial temporal considerations. In other words, NMFS does not contemplate the lag time before the effect of the mitigation is observed on population recovery. Since the response of the affected populations will not be immediate, these extremely low fish populations will remain at risk for extinction (and recovery failure)(Liermann and Hilborn CJFAS 1999). For example, where there are inadequate numbers of males to females causing unsuccessful spawning or a natural

disaster occurs, the compensatory effect (when the fish populations are at critically low levels) could very well result in extinction.

NMFS' use of the Leslie matrix to analyze future conditions results in this deficiency. The Leslie matrix produces an intrinsic population growth rate, but it does not consider the incremental changes in population abundance over time likely to result from the proposed action. Because the hydrosystem has imposed substantial impacts to the affected salmon stocks, driving many of the listed populations to escapement levels less than the survival metrics described by a number of prominent authors, it will take years for the affected salmon stocks to recover. Where the intrinsic growth rate is greater than 1 (a function of survival changing at each life stage due to mitigation actions, that is, the lambda value), it may take 50-100 years (entirely dependent on lambda and the population at the time of dam removal) for the population to reach historic levels. This assumes that everything else remains constant, which obviously it will not since habitat and oceanic conditions do not remain static. Therefore, NMFS would have to insure static conditions, which is impossible.

Even though NMFS theoretically removes the survival impacts of the hydrosystem, the full mitigation concept still ignores the probability of extinction. If annual survival rates for juvenile and adult salmon somehow magically increased to a level that existed prior to development and operation of the dams, it does not follow that the affected populations are free from the deleterious impacts of the dams. They are still at critically low levels because of past impacts and will remain at risk for many years. During this period, the federal hydrosystem cannot shirk its responsibilities to recovery of the salmon simply by declaring that it has met a fictitious "full mitigation" standard.

By analogy, it would be medically imprudent that once having removed the blood clot (viz. dams) that caused the heart attack and associated tissue damage (viz. low salmon populations), if the cardiologist failed to prescribe appropriate medication and cardiac rehabilitation procedures during the recovery period.¹ While the heart attack patient may have survived the initial trauma, the proper medical procedures during rehabilitation are nevertheless essential for a full recovery.

2. NMFS' Reach survival data does not address delayed mortality.

NMFS uses only a "low-delayed mortality" input value assumption for Snake River Spring/Summer Chinook ("SRSSC"), where NMFS assumes **NO** delayed mortality of non-transported fish is expected to occur. This assumption removes delayed mortality from the calculation of survival improvement needed to meet the full mitigation concept, squarely placing the burden of delayed mortality on the other "Hs". This assumption is unreasonable in light of the body of information developed collaboratively through PATH and peer-reviewed. Scientists at the CRITFC and the USFWS believe that this delayed mortality is significantly attributable to the juvenile migration through the FCRPS, including bypassing and barging.

NMFS disregards critical scientific evidence in its review of delayed mortality. Despite its awareness of differential mortality, and the low smolt-to-adult-return data ("SARs") of Snake River spring and summer chinook, NMFS continues to disavow the evidence of delayed mortality. NMFS continues to support performance standards that simply look at the survival of juveniles while they are in

¹ This analogy is not entirely appropos. NMFS does not propose removing the blood clots. Instead, NMFS asserts that it can remove the impacts of the blood clots by making improvements elsewhere in the system.

the FCRPS, without regard to their poor return rates as adults. In so doing, NMFS is electing to ignore important scientific documents of the last several years.

Deriso et al. (1996) and Schaller et al. (2000), using adult (recruit per spawner) data found that the differential mortality between seven Snake River spring chinook stocks and six down river control stocks averaged 0.17 per project, or a mortality of approximately 0.77 for eight projects. Because this level of mortality was far in excess of that indicated by passage models, Deriso (op. cit.) described the additional mortality as delayed mortality.

These results are consistent with the low survival rates of transported Snake River spring/summer chinook observed by Toole et al. (1996). During the PATH process, Toole (op. cit.) established the goal of a range of between two and six percent SARs for survival and recovery. This goal was based on several pieces of information including the performance of the stocks during the 1960's prior to the construction of the last four hydro projects, and the recent performance of spring chinook in the Warm Springs River, an Oregon river above only two dams. Survival data (SARs) based on PIT tag data Weber et al. (in prep), indicate that for the most recent decade Snake River wild transported spring/summer chinook survived on average less than 0.5%. Thus the survival level would have increased four-fold for the stocks to meet the minimum survival goal (2%), and an approximate eight-fold increase to achieve a level of recovery (4%).

These studies show high levels of delayed mortality that cannot be observed using survival estimates of juvenile fish. While it may be speculated that the poor survival rate is not related to the hydropower system, to date no one has been able to describe a biological mechanism that would result in collapsing the SRSSC stocks without impacting the downriver control stocks. NMFS' response is to theorize that the genetic variances between Snake River spring chinook and downstream control stocks account for their differences in mortality. But genetic differences are not by themselves agents of mortality and must be at least conceptually linked to one or more biological mechanisms, such as starvation, predation or disease.

Ocean starvation appears to be an unlikely hypothesis since it is difficult to believe that some stocks of the highly migratory chinook would suddenly find themselves unable to locate prey in the North Pacific. The trophic structure of the eastern North Pacific Ocean is based on large-scale wind-driven upwelling events that produce large, temporary gyres. These gyres bring cold, nutrient rich water to the surface where food chains form. Gyres repeatedly form and dissipate throughout the range of spring/summer chinook that extends from Northern California to the Gulf of Alaska. Because both the Snake River chinook and their downriver (control) counterparts occur within this range, it seems unlikely that the Snake River chinook would be unable to locate prey while the downriver stocks could. Likewise, predation should not account for the differences in mortality since it is improbable that Snake River fish would begin to encounter a previously unencountered predator while the downriver fish wouldn't.

Disease, on the other hand, may account for some of the differences in mortality. NMFS described a scenario over a decade ago wherein a combination of stress and injury sustained during bypass, collection and transportation causes the ubiquitous but generally asymptomatic Bacterial Kidney Disease to flourish (Williams 1989). This phenomenon is well known among fish pathologists (see for example Warren 1991). BKD takes several months to run its course and thus mortality would not occur until the early ocean life stage, the stage at which differential mortality is thought to occur. If NMFS now believes this hypothesis to be untrue, it should provide a more plausible explanation.

The BiOp ignores the Scientific Review Panel (“SRP”) and the Weight of Evidence process , which were used to evaluate PATH’s conclusions. Although some have emphasized the importance of ocean cycles, the fact that all Snake River salmon stocks obviously haven’t collapsed every sixty years, or on any other potential cycle, indicates that a climatic cycle is not to blame. Instead, this hypothesis would seem to require that a new and unexplained oceanic phenomenon would have to have come into play coincidentally with the construction of the last four dams. It is important to note that during PATH’s Weight of Evidence process, the SRP assigned very low weights to the Regime Shift Hypothesis as shown in the following table:

Reviewer	Carpenter	Collie	Saila	Walters
Weight	0.01	0.1	0.15	0.2

Overall, these were the lowest weights assigned by the SRP for any hypothesis.

The tribes are unwilling to continue to bear the burden of this delayed mortality. While the Northwest Fisheries Science Center conducts all of the experiments and monitoring that it would like to attempt to conclusively pin down the process by which delayed mortality occurs, the salmon and tribal fisheries bear the pain and the risk. Instead, the United States, in consultation and collaboration with the tribes, must craft a risk-averse solution for salmon that fairly allocates the burden of delayed mortality.

B. NMFS' Reach survival data is not representative of a system unaffected by the dams.

The reach survival approach taken by NMFS in the Opinion, albeit explained in scattered sections of the document, is based on hypothetical estimates of survival that would occur in the mainstem Snake and Columbia rivers in the absence of the FCRPS. The extrapolation of reach survival information as representative of a river system free from the effects of the FCRPS is troubling. The chosen data sets hardly reflect a reach, let alone, a river system unaffected by hydroelectric development. Each data set, juvenile and adult, reflects a river reach where:

- Water quality regimes have changed, including temperature profiles during the affected migration periods;
- Predator populations changed including the introduction of numerous exotic species such as Walleye and Bass which prey upon juvenile salmon;
- The food web has changed such that prey species for salmon are no longer abundant in the mainstem;
- Flow regimes changed by flood control affect the estuary and early ocean entry conditions; and
- Estuary conditions, particularly its physical conditions, have changed by the storage operations of the FCRPS including operations for flood control.

The above changes are described in greater detail in the draft BiOp and do not need further attention here. Subsequent sections of our comments elaborate on technical concerns with NMFS' calculation of the full mitigation standard.

- C. NMFS' Reach survival findings are inconsistent with the Northwest Power Planning Councils estimate of losses attributable to the hydrosystem.

Unlike NMFS, the NPPC's Goals and Losses Report addressed the issue of losses attributable to the development and operation of the hydrosystem from a total population standpoint. Also the NPPC addressed the issue using a variety of methods, including but not limited to reach survival. "Using these methods, the Council estimated that declines in run size due to hydropower development and operation range from about 5 million to 11 million adult fish [annually]. This compares with the total decline from all causes of about 7 million to 14 million adult fish. The Council recognizes that data are limited and that other approaches to calculating losses may be possible, but it anticipates that all reasonable approaches would result in loss estimates in this range." Columbia River Basin Fish and Wildlife Program, 1987, p.38.

III. SECTION BY SECTION REVIEW OF CHAPTER NINE

The proposed actions in Chapter 9.0 Reasonable and Prudent Alternatives suggest that improvements in all of the H's are significant enough to avoid a jeopardy determination for listed stocks passing through the FCRPS. The BiOp does not discuss the considerations that NMFS took into account in developing these draft Reasonable and Prudent Alternatives (RPAs). More effort should be spent in explaining and providing methodology details used to construct the RPAs. Furthermore, the proposed action in the draft BiOp assumes that the 1995 BiOp hydro measures and aggressive juvenile improvement measures can be implemented. Based on the performance of the Action Agencies and NMFS over the last 5 years, this assumption is unreasonable.

NMFS also fails to discuss the feasibility of implementing the proposed action. Some primary examples:

- Particular measures or survival improvements may be infeasible in the sense that they simply cannot be achieved regardless of the degree of effort. The draft BiOp estimates of potential survival improvements during the freshwater rearing stage are an example.
- A measure may be technologically, environmentally, or economically infeasible, in which case it cannot be required as a reasonable and prudent alternative in a biological opinion (refer to definition of reasonable and prudent alternative).
- Questions of feasibility and adverse impacts are relevant to how NMFS weighs trade-offs among alternative measures. The draft BiOp sets forth a broad range of potential measures to conserve listed salmon and steelhead stocks without doing any comparisons between them.

The action proposed in the draft BiOp maintains the *status quo* found in the 1995-1998 FCRPS BiOp, which contains passage improvements (including increased flows and spills during migration periods) and increased transportation over pre-1995 conditions. The draft BiOp also describes the models used to evaluate the effect this action would have on Snake River and UCR ESUs. Results from these models provided NMFS the information to declare jeopardy to listed salmon and steelhead from the proposed action. These same models are also used to evaluate the effect of the draft RPA on listed stocks.

The draft BiOp describes an alternative to the proposed actions that was determined to pose jeopardy to 8 of the 12 ESUs. This alternative uses the same hydrosystem improvements described for the proposed action with additional improvements to aid juvenile and adult passage. In general, improvements in juvenile passage are supported by experiments and only increase survival slightly over the originally proposed action. The greatest improvement over the proposed action can be attributed to adult passage improvements, which are assumed to decrease FCRPS adult mortality by 25% (or increase adult survival by 7%) and juvenile pool survival improvements of 10% per pool. These conclusions are completely hypothetical and not supported by empirical information. These additional improvements increase life-cycle survival by approximately 30% over base condition, whereas, the original proposed action increases survival by roughly 19%. However, if adult and juvenile pool survival were not arbitrarily assumed to increase, then the draft RPA would only increase survival approximately 1% over proposed action.

9.1.2 Hydro Actions

Measures to improve direct passage survival are needed, but other aspects necessary for recovery are omitted in this section. Examples include restoring life history diversity, ecological integrity, mainstem habitat and improving water quality parameters. These critical areas are largely missing here. The need for these is clearly emphasized in *Return to the River* (Williams et al. 1996), the Independent Scientific Advisory Board's *Review of the Corps of Engineers' Columbia River Fish Mitigation Program* (NWPPC 1999) and in Reiger et al. (1989).

NMFS staff have told CRITFC staff that this draft biological opinion represents everything that can be done with the current hydrosystem to recover listed species. Upon review of the document, however, it appears that the draft opinion measures are essentially status quo, including operations for flow, spill, mainstem habitat improvement and capital construction measures to attempt to bring the FCRPS into compliance with the Clean Water Act Standards.

NMFS gives no indication how it will fund measures it proposes in the draft opinion. A number of capital construction projects at the dams for fish passage are endorsed that will require substantially increased budgets appropriated by Congress. At recent System Configuration Team meetings, the Corps and NMFS staff have speculated that the Corps' capital construction budgets over the last three years of about \$70-75 million per year would have to be nearly doubled to pay for the measures in the draft biological opinion. Whether Congress appropriates these funds is uncertain, but given Congress' past record, it is unlikely that it will. A more direct and certain approach to improve fish passage survival and mainstem habitat and water quality would be to construct a normative hydrograph and provide controlled spill during the entirety of fish passage as recommended by CRITFC's member tribes (Nez Perce et al. 1995).

9.1.3 Offsite Mitigation

If direct and delayed mortality was reduced where it is caused, i.e. in the hydrosystem, the need for offsite mitigation would be significantly reduced. Offsite mitigation fails to correct for stocks that have their entire freshwater life history in the mainstem and are impacted by the FCRPS (i.e. Snake River fall chinook).

9.1.4 One and Five Year Plans

The efficacy and cost of this draft opinion are highly dependent upon the details contained in the operating agencies' one and five year plans, yet they are not presented in this draft opinion for review and comment. Instead, they are given ex post facto status, and CRITFC and member tribes are left to guess what specific measures the operating agencies will engage in and how effective they will be to meet the performance standards. The term "steady progress" is undefined, and this can be interpreted at the whim of NMFS and the federal action agencies. This "standard" is much more lax than the standard applied to harvest. How can the RPAs be implemented to meet the performance standard in a set time without a precise definition of steady progress, for each project and the entire FCRPS? Does this mean a particular project must be 3% from achieving the standards in year 6 or is the standard met when the reach survival in within 8% in year three? For example, how can judicious choices be made on improving fish passage with limited budgets at specific projects without a carefully defined rate of progress (i.e. x % of improvement for n year)?

9.1.5 Comprehensive 5 and 8 year Check-ins

We have to seriously question whether NMFS will be able to resolve the critical uncertainties outlined in this and other sections of the BiOp, in time to evaluate whether "steady progress" is being made on the proposed performance standards. NMFS is proposing that critical uncertainties that have existed for decades would be resolved in two salmon brood cycles. This is highly unlikely, for technological, logistical and even political reasons, aside from biological uncertainty. For example, adult PIT-tag detection capability is lagging behind schedule. In addition, CRITFC requested funding of studies in 2001 to address uncertainties regarding the delayed and cumulative mortality to juvenile salmon passing through multiple screen bypass systems. However, the Corps and NMFS placed these low on the priority list making it unlikely that these studies will occur.

NMFS proposes that the resolution of uncertainties combined with the performance standards will adequately indicate if the lambdas (λ) for particular ESUs are meeting benchmarks. In addition, NMFS contends that lambdas alone are the appropriate measurement of survival and recovery. Given normal environmental and stock variability, this approach appears unscientific. As mentioned previously, lambdas cannot accommodate density dependence. Further, lambdas are highly sensitive to different calculation methods.

Lichatowich and Cramer (1979) estimated that, using NMFS' approach to measure growth rate/abundance, it would take 20-30 years to produce an 80% chance of detecting a 50% change in population status. It would be far better if NMFS employed performance standards that are inclusive of other measurements of stock recovery from a life-cycle and spawner to spawner perspective. Measurements, such as increasing mainstem habitat and life history diversity, are important to acquire this perspective. For example, NMFS should adopt:

- Systematic measurements of physical, chemical and biological parameters that are more statistically sensitive to change and that highly influence survival. Lichatowich and Cramer (1979) estimated that using this approach, only 8-10 years would be required to detect a 5-15% change in population status.
- Smolt –to– adult (SAR) return rates. A weighted mean or range could be set to be accomplished by the end of the performance period, which would accommodate variability in individual years. In any case the range or variability should not exceed the bottom end

of the SAR goal, which we believe is 2%. The SAR should be linked to a recovery goal, such as 2-6 % as recommended by PATH.

- Reduce adult passage delay and prespawning mortality by 50% by 2006.
- Ensure an 80% fish passage efficiency (FPE) ² by 2004 and 90% FPE by 2005 ³
- Eliminate juvenile salmon stranding and other problems related to hydrosystem power peaking.
- Provide 9,000 acres of spawning habitat for Snake River fall Chinook.
- Provide 40 miles of fluvial habitat for core mid-Columbia chinook.

NMFS must consider evidence of delayed mortality directly attributable to the hydrosystem. NMFS should not continue to ignore the growing body of studies and research that clearly illustrate that passage losses can occur days and even weeks after passage. For example, relative survival studies at Bonneville Dam (Gilbreath et al. 1993; Dawley et al. 1996) show that delayed mortality for test subyearling chinook, whether from the dam to the estuary or as adult returns, varied by passage route, with screened bypass passage being the worst route. Kostecki et al. (1987) noted that Atlantic salmon smolts that pass through turbines suffered brain and muscle lesions that significantly increased delayed mortality when fish were held for 8 days. IDFG (1998) and NMFS (1999) in their passage white paper, state that fewer adults return from PIT-tag juvenile salmon that have passed through one or more screen systems in the FCRPS. And NMFS, in the 1998 Supplemental Biological Opinion, notes that no PIT-tagged juveniles that passed through the McNary screen bypass system in 1994 returned as adults.

Using SARs and physical measurements such as fish passage efficiency in standards addresses the issues of delayed mortality and protection for the runs at large, not just a small sample of replicates for one stock.

9.1.6 Advance Planning for Breach or other Additional Actions

In recent System Configuration Team meetings on planning budgets for the Corps' Columbia River Fish Mitigation Program for 2001, CRITFC included a category of \$20 million to fund additional studies and design work leading to breaching implementation of the Lower Snake dams. NMFS and the operating agencies did not support this funding and removed it from the priority list, substituting a mere \$750,000 to continue feasibility work. This is clearly inadequate to seriously pursue breaching in the near future.

9.2 Performance Standards

NMFS mentions other parameters to measure recovery, but does not include them *per se* in this draft opinion. NMFS should describe these parameters in detail in this opinion as part of the RPA. As stated previously, the proposed performance standards only address direct measurement of project and

² Fish passage efficiency is defined as salmon passage through non-powerhouse routes, such as a spillway or sluiceway. Because these routes have been shown to cause significantly less delayed mortality than powerhouse passage, the use of an FPE objective gives an additional benefit to recovering the salmon resource.

³ Not including the additional benefit of reducing delayed mortality, a 90% FPE objective or standard for yearling Chinook is equivalent to a direct survival of 97-98% per dam (assuming 11% per project turbine mortality and 1-2% per project spillway mortality). Not including delayed mortality or reservoir mortality, hydrosystem direct survival through nine dams with a 90% FPE per dam objective or standard is 76-83%; hydrosystem direct survival through nine dams with a 95% per dam survival standard is 63%.

reach survival and their hypothesized relationship to population growth/abundance. Based upon the work of Lichatowich and Cramer (1979), it is not likely that these reach survival measurements will be statistically sensitive to population change. Therefore, in the ten-year timeline envisioned, NMFS will not be able to measure changes within the hydrosystem that may affect stock production for entire stocks, much less individual ESUs. The proposed performance standards fail to address delayed mortality, fail to address habitat quantity and quality and fail to address life history diversity. Measurement of these parameters can be accomplished by physical, chemical and biological monitoring. Examples include measuring SARs, measurement of stock fitness such as spawner success and distribution and size at spawning, and mainstem habitat monitoring for environmental attributes such as primary and secondary production.

9.2.2.2.1 FCRPS Hydro Performance Standards

The action agencies have the authority to provide more aggressive measures to reduce direct and indirect mortality. For example, more spill could be provided for longer periods to protect the full range of the juvenile and adult migrations. Congressional authorization to implement these actions already exist. NMFS' assumptions about experimental measures resulting in an increase in survival are not explicit. For example, NMFS' assumptions regarding survival gains from installation of minimum gap runners in turbines are completely speculative and not consistent with the extant study results.

The draft BiOp assumes that a 95% per dam survival standard is achievable at the five FERC Mid-Columbia Public Utility District (PUD) hydroprojects by the end of the opinion period. This is highly unlikely. For example, dissolved gas created by the upstream federal projects (Grand Coulee and Chief Joseph) and the lack of progress in abating gas at the PUD projects will prevent spill levels necessary to meet the survival standard within the timeframe outlined in the draft RPA. The draft BiOp fails to contain an RPA or mechanism to require the PUDs to meet the survival standard, thus, the assumption that the 95% survival standard can be met at their projects is completely speculative and unreasonable.

NMFS should completely describe what "factoring" will be necessary to, "ensure that the progress evaluation is truly assessing progress of action undertaken and the results are not masked by ambient conditions". This could be significant if survival results are questionable as to meeting standards.

Meeting the proposed recovery metrics in the draft opinion is not equivalent to a "full mitigation standard" for the lost productivity of salmon stocks caused by the presence and operation of the FCRPS. This is because hydrosystem losses, whether performance standards are met or not, will not be fully compensated through hatchery supplementation, harvest reductions or habitat improvements. Neither NMFS, nor the action agencies are proposing a "no net impact" concept in this draft opinion.

If the RPA actions do not meet the NMFS standards at midpoint, it is not likely that there will be enough time to implement other actions to meet the standards by the end of the RPA period. This is because of the considerable "lag" time that is necessary to turn funding of projects into increased survival and production of listed stocks. For example, if by 2005, a decision is made to install a surface bypass system at Bonneville Dam, it would take the Corps four or five years to design, model and build the structure. This would not allow time to evaluate the efficacy of the structure with respect to the simple and incomplete metric of juvenile passage survival, much less analyze how this metric would relate to the draft opinion recovery goal.

NMFS is incorrect in asserting that breaching the four lower Snake dams will not assist other ESUs. Breaching the dams will restore physical, chemical and biological productivity that will be transported downstream into the estuary plume, because rivers are fluvial systems (Ryder and Pensendorfer 1989). For example, removing the Snake River dams will improve water quality parameters for salmon in the lower Columbia by reducing dissolved gas levels and temperatures and increasing turbidity. A few years after the dams are breached and the majority of fine sediments are transported downstream, more natural turbidity regimes will be reestablished in both the Lower Snake and Lower Columbia Rivers. Junge and Oakley (1966), Skalski et al. (1996) and NMFS (1999 White Paper) note that natural turbidity regimes are correlated with increased salmon survival and stock production.

Physical performance standards should include mainstem habitat quality (i.e. increases in riparian and channeled habitat; increases in invertebrate production), fish passage efficiency measurements over dam (using hydroacoustic and radio telemetry methods) and other physical measurements at dams (i.e. reducing power peaking). NMFS should clearly describe these elements and include them with biological performance standards as objectives that must be met to achieve recovery.

9.4.1.2 NMFS Midpoint Evaluations in 2005 and 2008

Changes in FCRPS operations would affect the 2001 outmigrating year class. This brood year will return in 2004-5. FCRPS system configuration changes would begin to come on line in 2001, but major changes, such as surface bypass system and improvements to adult fishways would not be in place until 2006-7. Juvenile fish experiencing these benefits would not return until 2010. Given these circumstances, how would NMFS view achievement of performance standards, if they were not met at the midpoint evaluations? It is unclear how this would be evaluated.

9.5.2.1 Hydrosystem action- NMFS regional implementation forum

From the tribal perspective, this forum has merit as an information exchange body, but not as a decision making body. It has representation at the mid-manager level, but not policy representation. Further, the NMFS forum has no formal dispute resolution mechanism. Furthermore, tribal resources, do not allow for pro-active tribal involvement. Under the Secretarial Order, NMFS must consult with the tribes on all actions, planned and in-season, that impact tribal resources. NMFS, in consultation with CRITFC's member tribes, should establish a dispute resolution mechanism to attend to FCRPS operations and configuration, with the courts being the ultimate arbitrator.

9.5.2.2 Operations

The foundation for river operations for the next year should be decided by August 1. This is the date for the beginning of the next water year and is also the date that non-power provisions under the Pacific Northwest Coordination Act are finalized. The plan should be refined using ENSO diagnostic tools to predict "La Nina," "El Nino" and related events, and when the water supply forecasts are available on January 1 of the migration year in question. NMFS and the action agencies should provide technical consultation with CRITFC and member tribes throughout all phases of river operations planning, including consideration of tribal recommendations for river operations. Currently, NMFS and the action agencies refuse to (because of "proprietary" reasons) share SSARR flow and reservoir forecast

data in a timely manner to allow CRITFC to make informed recommendations for in-season river operations. Tribal recommendations continue to be largely disregarded.

9.5.2.3 Configuration

NMFS and the Action Agencies must incorporate all tribal system configuration recommendations in the SCT and in SCT umbrella groups, such as the FDRWGs. In recent SCT meetings, NMFS and the action agencies have declined to support CRITFC priorities for projects to meet long-term Clean Water Act standards. If the federal government agencies continue these actions, RPA measures will not be met. NMFS must resolve these inconsistencies to allow for recovery to move forward. NMFS and the action agencies must also engage the CRITFC tribes in meaningful consultation on system configuration.

9.5.2.4 Water Quality

As mentioned, the Action Agencies and NMFS do not support implementation of capital construction projects to improve water quality. At the September 8, 2000 SCT meeting, the Corps said that it does not support using the Columbia River Fish Mitigation Program (CRFMP) to fund capital construction projects at federal dams which would reduce total dissolved gas and temperatures toward standards. The Corps suggested using some other unidentified funding source. NMFS and the Corps, however, are obligated to comply with the Clean Water Act. The Corps does not have the discretion to refuse Clean Water Act compliance.

9.5.2.5 Tribal Coordination on Hydro Actions

As mentioned in informal consultation on this draft opinion, CRITFC and its member tribes lack the resources to fully participate in the NMFS forum, with its multitude of technical committees and subcommittees. Unless the federal agencies provide CRITFC and its member tribes with adequate resources for full participation, NMFS cannot expect CRITFC and its member tribes to meaningfully engage at the technical level in the NMFS forum. Further, the NMFS forum is not appropriate for policy consultation under the Secretarial Order. The tribes' definition of consultation means that the federal government and the tribe(s) engage in discussions and arrive at a mutually agreeable position at the policy level *before* an action is taken that impacts treaty-reserved and trust resources. The burden of Secretarial Order consultation remains on the NMFS.

9.5.2.9 Approval of Plans

As the Action Agencies develop their one and five year plans, we ask NMFS and the USFWS to provide timely consultation on specific tribal recommendations for the development of the plans. This consultation should occur well before a draft plan is released, so that tribal recommendations are fully considered in the draft plan.

9.6.1 Hydro Measures

Many of the hydro measures in this draft opinion have not changed since the 1995-1998 draft Biological Opinion for the FCRPS was issued. Therefore, CRITFC incorporates by reference CRITFC comments to the NMFS 1995-1998 draft Biological Opinion on Operation of the FCRPS, comments to the NMFS 1998 draft Supplemental Biological Opinion on Operation of the FCRPS, comments to the

NMFS 1999 draft Supplemental Biological Opinion on Operation of the FCRPS, the CRITFC 1999 fall chinook harvest biological assessment, the 2000 CRITFC spring season harvest biological assessment, the CRITFC and member tribes' comments on the *Draft Lower Snake River Juvenile Salmon Migration Feasibility Report/Environmental Impact Statement* and CRITFC comments to the October, 1999 NMFS white papers, *Passage of Juvenile and Adult Salmonids past Columbia and Snake River dams* and *Salmonid Travel Time and Survival Related to Flow Management in the Columbia River Basin* (CRITFC 2000a), and the *CRITFC 2000 River Operations Plan* as germane to the proposed actions in this draft opinion.⁴

9.6.1.1.1 Improving Water Management

As recommended in comments noted above and in the *CRITFC 2000 River Operations Plan* (CRITFC 2000b) submitted in April 2000 to NMFS and the Action Agencies and also recommended in *Return to the River* (Williams et al. 1996), re-creation of a normative, mainstem hydrograph is critical to recover listed stocks. Seasonal flow targets that are often missed, do not provide the habitat or migratory conditions necessary for salmon and other anadromous fish stocks. Flood control shifts may produce some additional flow, but modifying flood control rule curves to allow for more storage earlier in the water year for spring and summer migration is necessary if a riverine ecosystem is to be restored. The RPA should be modified to incorporate these elements to re-establish a normative hydrograph.

Further, the lower Columbia flow gauging point should be moved from McNary to The Dalles. This is because The Dalles has a longer historical record and flood control studies use The Dalles as a key reference point.

In addition, the RPA should incorporate long term climate trends, including global warming, into consideration for water management for salmon flows. For example, as a result of global warming trends, reduced snowpack could allow for modification of flood control rule curves. This would allow storage of more water in the spring for late spring and summer flows.

9.6.1.1.5 Improving Water Quality

As mentioned previously, turbidity is an important water quality parameter linked to salmon productivity, as is dissolved oxygen. Dissolved oxygen has been shown to be depressed in the lower Columbia River (Clark and Snyder 1970 in Diamond and Pribble 1978). Long term structural measures at dams to abate dissolved gas, structural changes to reduce temperatures in fishways, and keeping juvenile fish out of screened bypass systems and barges that subject them to higher temperatures (compared to in-river temperatures) also must be included in the biological opinion. The RPA must try to take into account future global warming (natural and human induced) and mitigate.

9.6.1.1.6 Enhanced operation and maintenance of fish passage facilities

As discussed in recent SCT meetings, the Corps has placed a lower priority on maintaining adult fishways and appears willing to risk complete failure of certain fishways that have not been maintained

⁴ These include December 16, 1994 Comments from Ted Strong, CRITFC to Will Stelle, NMFS; February 10, 1995 comments from Comments from Ted Strong, CRITFC to Will Stelle, NMFS; April 3, 1998 Comments from Comments from Ted Strong, CRITFC to Will Stelle, NMFS; and February 2, Comments from Donald Sampson, CRITFC to Brian Brown, NMFS and Wy-Kan-Ush-Mi Wa-Kish-Wit (*Spirit of the Salmon restoration plan*).

for several decades. Funding to retrofit and improve adult fishways remains extremely limited because the Corps and NMFS place higher priorities on installing and maintaining new juvenile screen bypass systems.⁵ For example, five years after installation, the McNary extended length screen system still demands \$ 4 million of the Corps 2001 CRFMP budget to attempt to solve “debris problems.” The RPA should be modified to require the Action Agencies to follow recommendations in the *1993 Tribes and Fishery Agencies’ Detailed Fishery Operations Plan*, because the Plan is more stringent and protective of salmon than the Corps’ Annual Fish Passage Plans. This will avoid the annual scenario when CRITFC, NMFS and the other state and federal fishery agencies extensively comment on necessary improvements to the Corps Annual Fish Passage Plan, and these comments are disregarded by the Corps.

9.6.1.2.1 Flow Management Objectives in Mainstem Columbia and Lower Snake Rivers

Mainstem Flows- Normative River Hydrograph Concept

The RPA should be modified to require that runoff and storage volumes be managed to more closely approximate the natural, historic river hydrograph (Williams et al. 1996; CRITFC 2000b). A normative river hydrograph promotes physical, chemical and biological parameters necessary for anadromous fish production. For example, turbidity regimes established by a peaking hydrograph have been shown to enhance anadromous fish production in the mainstem (Junge and Oakley 1966) and estuary (Bottom and Jones 1990; Maser et al. 1988). A peaking hydrograph also transports large woody debris and inorganic and organic sediment creating habitat diversity and a base for primary and secondary invertebrate production (Lisle 1986; McMahon and Holby 1992; Johnson et al. 1995). Biodiversity is best protected in rivers with natural flow regimes (Power et al. 1996).

The normative river hydrograph includes meeting flow objectives at each of the main river points- Lower Granite, Priest Rapids and The Dalles,⁶ while retaining water in storage reservoirs to meet integrated rule curves and other biological criteria. The concept relies on flexibility in flood control, flow augmentation from Non-Treaty storage and purchase of flood control space, and appropriate contributions from irrigation withdrawals.

The Action Agencies should provide normative hydrograph flows for salmon and steelhead based on values exhibited in Table 1. These values were generated by the NWPPC’s GENESYS hydroregulation model using the 50 year flow record and are based upon a sliding scale formula founded upon the water year runoff class- high, medium and low. We would be pleased to provide the technical specifications for the model runs at your request.

Once the normative hydrograph is established for any particular year, as determined by state-of-the-art meteorological and hydrological forecasting methods⁷ (see *CRITFC 2000 River Operations Plan*)

⁵ This is particularly troublesome because it appears that the screen bypass systems are likely significant sources of delayed mortality.

⁶ The Dalles is appropriately the index point because it has been *the* lower Columbia point where flows have been measured since the 1800s. The use of McNary Dam as a downstream index point is not appropriate because storage and power operations in the John Day pool perturb flows below John Day. These perturbations are counter to a normative hydrograph in the lower Columbia and estuary and are not evident if McNary is used as the lower river index point.

⁷ The inflow projections utilize Water Supply Forecast (WSF) volumes, subject to monthly updates, and 1-5 month climate forecasts provided by NOAA/National Weather Service. A weekly spread-sheet analysis will be conducted once in-season management begins. This bi-monthly analysis shapes the forecasted seasonal volume inflow using climate forecast

the RPA should require the Action Agencies to meet recommended flow values on at least a weekly basis to fully protect the salmon resource and to meet performance standards stated above.

The RPA should be modified to incorporate the normative hydrograph as a non-power constraint in the annual Detailed Operating Plan and the Pacific Northwest Coordinating Agreement planning process.

Normative River Index Points

Table 1 describes CRITFC recommended flows for Priest Rapids, The Dalles and Lower Granite for high, medium and low water years. The high years average the top 25 water years from 1928-1978. The low years average the ten worst water years. These water years are represented by the April 1st January-July water supply forecasts (WSF) at The Dalles, to the operation of Grand Coulee. An average water year class is keyed to a WSF of 85 – 105 MAF. A high water year class is keyed to a WSF of >105 MAF. A low water year class is keyed to a WSF of <85 MAF.

The RPA should be modified to reflect implementation of these flows.

Table 1. Normative Hydrograph Flows (in kcfs) for High, Medium and Low Water Years at Lower Granite, Priest Rapids and The Dalles

	High Water Years (25):			Medium Water Years (14):			Low Water Years (11):		
	Lower Granite	Priest Rapids	The Dalles	Lower Granite	Priest Rapids	The Dalles	Lower Granite	Priest Rapids	The Dalles
October	18,000	91,000	120,000	19,000	90,000	120,000	17,000	88,000	115,000
November	22,000	91,000	122,000	20,000	95,000	123,000	19,000	96,000	122,000
December	35,000	93,000	144,000	28,000	89,000	126,000	26,000	90,000	124,000
January	39,000	88,000	148,000	31,000	66,000	111,000	25,000	60,000	95,000
February	42,000	102,000	166,000	34,000	70,000	121,000	21,000	58,000	92,000
March	60,000	126,000	211,000	41,000	91,000	154,000	29,000	59,000	103,000
Apr 1-15	89,000	139,000	249,000	67,000	112,000	197,000	41,000	64,000	117,000
Apr 16-30	112,000	153,000	276,000	84,000	125,000	221,000	50,000	66,000	126,000
May	135,000	209,000	356,000	117,000	160,000	285,000	78,000	83,000	166,000
June	118,000	291,000	427,000	100,000	250,000	363,000	75,000	190,000	266,000
July	55,000	164,000	231,000	47,000	125,000	180,000	38,000	169,000	214,000
Aug 1-15	48,000	143,000	201,000	43,000	119,000	170,000	37,000	100,000	145,000
Aug 16-31	44,000	114,000	167,000	40,000	94,000	141,000	35,000	91,000	132,000
September	34,000	84,000	125,000	34,000	82,000	123,000	34,000	87,000	125,000

information and should give managers a sense of how this runoff season will unfold. This early analysis also points to trouble spots that the federal operators should take action to avoid water shortages later during summer. Specifically, flows at MCDB, ARDB, GCL, HGH, LIB, and DWR need to go to minimum immediately and hold through most of winter.

Normative River Operational Criteria

- Shift refill priority from late June to late May, then pass all inflow in June. Such a strategy will generate higher peaks and faster passage speeds, and help mitigate the increasing effects of global warming. The average (all 50 water years) June peak is now 375 kcfs (similar to observed June 1996), versus the RPA target flow of 260 kcfs. The average June peak during high years is 427 kcfs, which is bank-full flow at Portland/Vancouver, as measured at The Dalles.
- Further modifications of system-wide flood control were focused at Grand Coulee, Brownlee, and Dworshak. The new study reclaims 5550 kaf from Grand Coulee, 2700 kaf from Dworshak, and 350 kaf from Brownlee, for a total of 8.6 MAF. There is a little extra flood risk to Vancouver and Portland. For flood flows of 550 kcfs, there is a 18% probability of flood risk (tribal plan), versus the RPA of 10%.
- Additional flow augmentation, from all Non-Treaty Storage (2.25 MAF) in Canada. During July 16th through September 30th, 1.75 MAF of Non-Treaty Storage is drafted from Mica. A total of 1.5 MAF is contributed from Upper Snake (includes Brownlee). Total: 4.7 MAF.
- Implement the Nez Perce Tribe plan for operations at Dworshak. The pool is kept full through July, then drafted to 1537 feet by late August, then 1520 feet by late September, using a normative hydrograph that benefits juveniles and adults.
- Use a “sliding scale” approach for high, medium, and low water years, based on the NWS April 1st January-July Water Supply Forecast for The Dalles.
- Refill the reservoirs by late May, instead of late June (current operation), then passing the inflow from June through September, and starting refill in October after treaty fishing season ends is key to the creation of the normative hydrograph. These change generate a higher June peak. This operation also serves to offset the effects of global warming where the spring freshet will move to earlier in the spring, which occurred in 2000.
- Modified flood control and the altered timing of refill is key to conserving water for spring migrants. This approach reclaims 5550 kaf from Grand Coulee, 2700 kaf from Dworshak, and 350 kaf from Brownlee, totaling 8.6 MAF.
- Some preliminary flood risk assessment has been conducted. A difference of observed daily flow at The Dalles relative to observed monthly flows was then applied to the monthly modeled results of the RPA and normative hydrograph studies, then back-calculated to generate modeled daily results.
- The flow at The Dalles is closely linked with flooding problems in the Vancouver and Portland harbors. Bank-full flow occurs at 450 kcfs. Flood flow occurs at 500 kcfs, and damages start at 500-550 kcfs. (Corps 1999) The highest flow at The Dalles for the normative hydrograph is 427 kcfs.

- Of the fifty water years analyzed, the estimated daily flows for the RPA operations exceeds bank-full but stays below flood-flow 14 times during spring, while the normative hydrograph plan exceeds bank-full but stays below flood flow 18 times. The RPA operations exceed daily flood flow 5 times, while the normative hydrograph plan exceeds flood flow 9 times. The normative hydrograph plan exceeds flood flows by 10-15% in volume, compared with the RPA operations.
- In assessing flood risk of the normative hydrograph plan compared to the RPA operations, there are two important considerations. First, because of global warming, there will be less chance in the future of the large snow melt peaks of the past, as more spring snow is melted earlier in winter or falls as rain. Second, the difference between the normative hydrograph plan and the RPA operations is 50-100 kcfs in the June peak flow at The Dalles. The normative hydrograph plan induces minor flood flows at Vancouver five times versus two times with the RPA operations during June of 1929-1978.
- Extra flow augmentation from July through September helps prevent the river from receding too quickly, and ensures stable lower Columbia pool elevations during treaty fishing season. For the mainstem Columbia, flow augmentation includes all non-treaty storage out of Canada (2.25 MAF) and 0.5 MAF from the Columbia Basin Irrigation Project and Banks Lake. For the mainstem Snake, flow augmentation includes 1.0 MAF from the Upper Snake, using the results from the Bureau of Reclamation's 1-MAF study, and 0.5 MAF from the Brownlee, on top of the existing 427 kaf. Total augmentation is 4.7 MAF.
- DWR is kept at minimum flow, when possible, from October through July. DWR stays at full pool, in most years, through July. The maximum outflow is limited to 14 kcfs during August. Flows in September average about 8 kcfs and the ending elevation is 1524 feet, on average, even though the draft limit is 1520 feet.
- Lake Roosevelt fluctuations are minimized from spring through summer. Lake Roosevelt is maintained at 1280 feet in spring, then 1283 feet through summer. The deep flood control drafts are cut in half.
- Flows in the mainstem Snake peak at 118 kcfs in May. Flows in the mainstem Columbia peak at 427 kcfs in June. This monthly value is comparable to the peak flow during the big flood year of June 1996, when daily flows reached or barely exceeded bank-full three times at Vancouver, but stayed below flood flow.

In summary, to achieve the normative hydrograph: (1) flexible flood control ensures greater refill probability during spring, (2) passing inflow during June ensures a much higher peak of the spring freshet, and (3) flow augmentation ensures better summer and early fall flows.

Inadequacy of the RPA Target Flow Concept to Recover Listed Salmon Populations

The RPA seasonal, target flow concept currently employed by the federal government does not adequately protect migrating anadromous fish through the mainstem, nor does it promote ecological diversity or establishment and enhancement of critical habitat functions and values. RPA 1 (1995-1998 FCRPS Opinion as modified by the 1998 FCRPS Supplemental Opinion) spring seasonal targets were not

met for one of two years at Priest Rapids Dam (135 kcfs) (FPC 1996, FPC 1997; FPC 1998). NMFS (1995-1998 FCRPS Biological Opinion) noted that these flow targets were the minimum necessary to avoid juvenile mortality. Additional mortality to non-listed juvenile salmon is associated with these inadequate flow conditions.

Flow volumes in the RPA are inadequate to even meet NMFS's flow targets, especially during summer months. Based on BPA's HydroSim modeling, the RPA will slightly increase flows in the lower Columbia (10 kcfs in the spring from 201 to 211 kcfs and 15 kcfs in the summer from 177 to 192 kcfs on the average over the 50 year record) while the RPA fails to increase in flows in the Snake (101 kcfs spring and 44 kcfs summer). Based on water provided under the RPA, spring and summer flow targets in the Columbia are only met in average to above average runoff conditions and are never met in the Snake. As an example of the magnitude of water volume that would be required to meet the flow targets above and beyond that supplied by the RPA, ODFW calculated volume deficits for meeting the Snake (50-55 kcfs) and Columbia (200 kcfs) rivers summer flow targets for the 50 year flow record using data provided by BPA (Table 2).

Table 2. Deficit water volume to meet the draft opinion's summer flow objectives in the Snake and Columbia rivers (HydroRegulation data from BPA analysis by ODFW).

Run-off Volume (MAF)	Snake River Deficit (kaf)	Columbia River Deficit (kaf)
50 yr average	1020	2260
53.5-70.9 maf (8 yr)	1680	8800
80.8-96.9 maf (12)	1080	3240
101.8-117.9 maf (20)	1080	1560
121.8-156.1 maf (10)	360	0

On average, the Snake River deficit is 1.02 MAF and 2.26 MAF for the Columbia. However, for the 8 lowest flow years (53.5-70.9 MAF), the deficit is 1.68 MAF for the Snake and 8.8 MAF for the Columbia.

In 1998, federal operators failed to meet the 135 thousand feet per second (kcfs) target flow at Priest Rapids. This resulted from the loss and non-replacement of about 0.8 million acre feet (MAF) of storage at Grand Coulee and caused significant fluctuation in flows. While to date, only one unconfirmed steelhead redd in the Hanford Reach may have been desiccated, in 1999 and 2000, these fluctuations caused the estimated mortality of at least 0.5-2 million juvenile bright fall chinook by stranding and entrapment in the Hanford Reach (P.Wagner WDFW pers.comm. 2000). Consultations were not reinitiated to address these circumstances. The opinions target flows of 220-260 kcfs at McNary Dam, 100 kcfs at Lower Granite Dam and 135 kcfs at Priest Rapids Dam are based upon the spring migration season as defined by the biological opinions. This is April 10-June 20 of each year⁸. If the averaged flows over the course of the season have been met, then the target flow requirement in the opinion has been met.

⁸ These dates are defined in the opinion as "planning dates". However, decisions to implement flows are made by the NMFS and federal operators in the Technical Management Team. The record indicates that since the 1995-1998 FCRPS opinion, despite the strong recommendations of the tribes and state agencies to implement flows outside the planning periods, flows to meet the opinion targets have never been made available for listed salmon outside of the planning periods. This has occurred even when substantial numbers of listed spring chinook were found migrating in the river (FPC 1995-1998).

Thus, flows during the season can remain significantly below the target for a substantial period of time. This was the case in the lower Snake River in 1999 as flows at Lower Granite dropped to nearly 80 kcfs in May during the peak of the spring and summer chinook migrations (DART 1999).

Under the normative hydrograph concept, the entirety of the juvenile and adult migrations will be protected. The current draft RPA calls for “planning dates” for implementation of the flow targets. These dates do not protect the initial and late portions of the run, nor do they protect the majority of the adult migration. For example, in 1999 and most other years, the onset of the juvenile spring migration occurs well before April 10. In 1999, thousands of listed and unlisted juvenile spring chinook migrants began to appear at Lower Granite Dam starting the last week in March (WDFW 1999). Flows at Lower Granite during this period in 1999, until April 12, remained below 80 kcfs. In 1999, subyearling spring chinook salmon were found in purse seine sampling in the Lower Columbia the third week in March (Backman 1999 unpublished data).

For the years 1995-1998, under the RPA target flow concept and restricted “planning dates”, average flows from McNary Dam have been reduced by about 30% from the last ten days in August to the first ten days in September (DART 1999). This compares unfavorably with a 4.3% reduction in flows from the last ten days in August to the first ten days in September for the period 1989-1993, prior to the biological opinions when the water budget was available (DART 1999). Based on the runoff forecast, technical experts of the tribes advised NMFS to adopt a sliding scale normative hydrograph using the same flow volumes identified in the RPA (CRITFC 1998 Recommendations to the NMFS 1998 Supplemental Opinion). These flow recommendations would result in substantially increased flows during late summer critical periods for the listed species' juvenile and adult migrations. Over 80% of the adult salmon and steelhead migrate through the mainstem after August 31, which is the end of the draft RPA “planning date”. Lichatowich and Cramer (1979) and McGee (1992) noted that adult spawner distribution was enhanced by the addition of flows, which in turn resulted in greater stock productivity. In an analysis presented to NMFS, CRITFC (1992) demonstrated that Snake River adult fall chinook migration through the Lower Snake River dams was interrupted when flow augmentation from Dworshak was terminated.

Power Peaking Operations

The RPA should be modified to avoid power peaking and ramp flows. Specifically, the RPA should include the following: To prevent stranding of juvenile migrants and to maintain riparian community integrity, Dworshak releases should be ramped at a rate of 6 inches per hour as measured at the Clearwater gage below Dworshak Dam. Adjust Dworshak release temperatures to meet the 68 degree water quality standard as measured in the scrollcase at Lower Granite Dam. At the Hells Canyon Complex, limit all flow reductions by ramping rates of no more than 6 inches per hour as measured at Lime Point. Such impacts have caused fishery managers to invoke ramping rate criteria to limit power peaking activities in tributaries to less than a two inch per hour change to shoreline areas (Hunter 1992). In the Hanford Reach, reduce power peaking from federal projects upstream to ramp flows a rate of no more than 2 inches per hour during the early emergence of Hanford fry (March 20- April 20).

Biological Rationale: The NMFS' 1995 FCRPS biological opinion and the draft RPA fail to implement criteria that restrict daily flow fluctuations. Extreme flow fluctuations that routinely occur in a 24 hour period from power peaking makes it difficult, if not impossible, for adult fishways and juvenile bypass

systems to consistently remain in hydraulic criteria. These criteria are essential to meet fish facility performance standards established by the state and federal fisheries agencies and tribes (DFOP 1993). Studies have shown that adult passage is significantly delayed by power peaking activities (DFOP 1993).

Power peaking can impact critical riparian habitat by limiting invertebrate production and diversity (Gislasen 1985) and is contrary to the normative river concept (Williams et al. 1996). Dramatic flow fluctuations from power peaking can strand juvenile salmon in shallow littoral areas causing direct mortality of many fish (Hunter 1992; Wagner et al. 1999).

Lower Columbia Chum Operations

In November 1999, concern for newly listed Lower Columbia chum salmon prompted NMFS to support higher flows of 150 kcfs from time of spawning to emergence of fry in March for chum that spawn below Bonneville Dam in November (NMFS 2000). CRITFC analyses indicated that these flows would require 5-6 maf over CRITFC's recommended flows for chum of 125 kcfs (CRITFC 2000b; Comments to the 2000 Supplemental FCRPS Biological Opinion). The water required to maintain winter flows at 150 kcfs, combined with extremely conservative flood control management by the Action Agencies, resulted in the failure of Lake Roosevelt to refill to the required elevation by the June 20 date necessary for summer flows that is required in the 1995-1998 FCRPS Biological Opinion. In conversations with CRITFC staff and in a letter to the federal operators (NMFS 2000), NMFS stated priority for Vernita Bar flows and refill of upper reservoirs for the 2000 migrations. Yet, in 2000, this did not happen. The RPA should be modified to prioritize refill of storage reservoirs for the purpose of flow augmentation for juvenile salmon over providing chum flows. NMFS should require the Corps to use back-water regulation, using the Willamette River, to enhance flows in the lower Columbia, reducing impacts to the FCRPS. Channel modifications at Ives Island and reasonable minimum spawning, rearing and incubation flows, not to exceed 125 kcfs should be implemented to protect chum populations. Further, power peaking activities should be curtailed during chum staging, spawning, incubation and early emergence.

Flow, Survival and Productivity

There is a strong relationship between flows and salmon productivity, as noted by NMFS in their appendix to the 1995-1998 FCRPS Biological Opinion entitled *Basis for Flow Objectives for Operation of the Federal Columbia River Power System*. We note that NMFS stated that the target flows in the 1995-1998 FCRPS Biological Opinion were the "minimum" necessary to avoid "high mortality" to salmon populations. We also note that these targets have been missed even on a seasonal basis in most years, yet these same targets are proposed in the draft RPA. We do not believe this information has changed.

Higher flows and attendant spill have been demonstrated to reduce juvenile mortality and increase smolt-to-adult returns (Petrosky 1991; Petrosky 1992; Petrosky and Schaller 1998). Flows and spill enable juvenile salmon to arrive at the estuary at proper size and physiological condition to survive at sea (CBFWA 1991). Lichatowich and Cramer (1979) found that the proper size and time of juvenile arrival to the estuary is a statistically sensitive parameter highly influencing stock productivity. Healy (*in*: Groot and Margolis 1999), Hilborn et al. (1993) and Cada et al. (1994) also found that there is a strong, positive relationship between river discharge and the survival of juvenile salmon and the size of salmon spawning populations. Northcote and Larkin (1989) note that flows increase the quantity and quality of river and

estuarine habitat diversity, which provides habitat conducive to rapid juvenile growth and subsequent high survival at sea.

Williams et al. (1996) and Dodge et al. (1989) note that anadromous fish production in the Columbia Basin and in rivers worldwide were founded and sustained upon the spatial and temporal cues and trophic systems created by the physical and chemical environment characterized by a normative hydrograph. Cada et al. (1994). These studies provide evidence of the linkage between flow, habitat accessibility and survival.

The following tables and attached graph, developed by the Fish Passage Center, illustrate a significant flow/survival relationship for these groups of summer migrants. Subyearling fall chinook PIT tagged at Lyons Ferry Hatchery and trucked and released at various sites in the Snake River from early June through early July show substantially lower survival estimates to Lower Granite Dam when average flows during the period of middle 60% passage at Lower Granite Dam drops below 50 kcfs. Flows in 2000 during the summer were lower than in 1999, and estimated survival to Lower Granite Dam remained lower for each weekly release group. The results here reflect the year-to-year difference for those fall chinook that outmigrated as subyearlings.

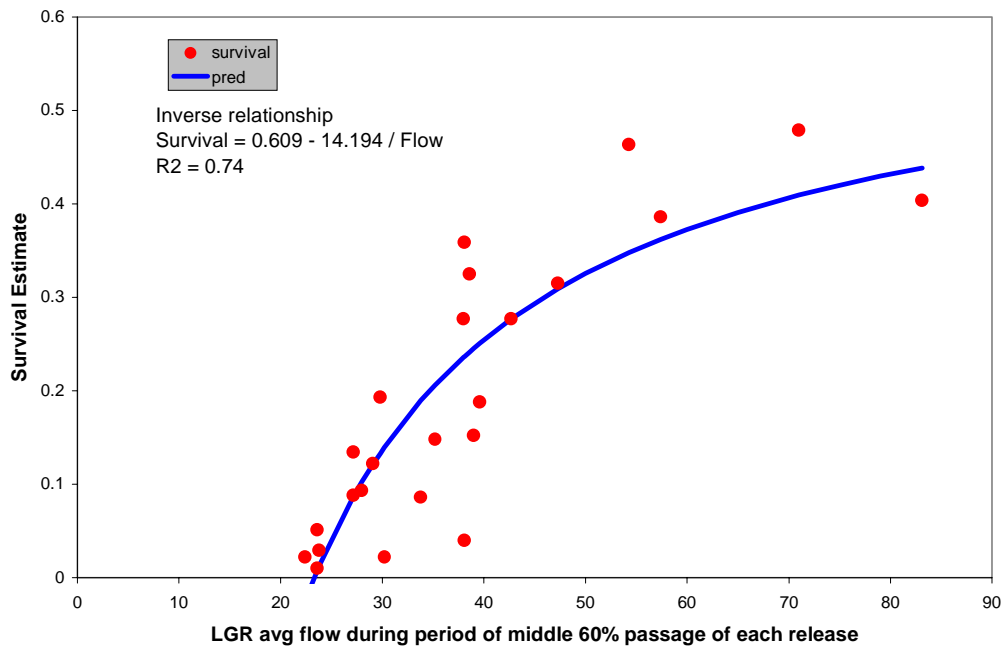
Release date	Year 1999 Pittsburg Landing AP (KM 346)			Year 2000 Pittsburg Landing AP (KM 346)		
	Survival to LGR	Mid-60% Passage	Avg. Flow (kcfs)	Survival to LGR	Mid-60% Passage	Avg. Flow (kcfs)
June 1	0.479	6/20-8/2	71.0	0.152	6/25-7/4	39.0
June 8	0.463	6/28-8/11	54.3	0.040	7/1-7/30	38.1
June 15	0.277	7/24-8/19	42.7	0.086	7/9-8/17	33.8
June 22	0.325	7/28-8/31	38.6	0.022	7/17-8/26	30.2
June 29	0.122	8/7-9/27	29.1	0.029	8/7-9/7	23.8
July 6	0.088	8/11-10/13	27.2	0.010	8/7-9/17*	23.6

* For July 6, 2000, release assume 80% date 10 days later than that of June 29 release.

Release date	Year 1999 Asotin (KM 234)			Year 2000 Above Captain John Rapid AP (KM 266)		
	Survival to LGR	Mid-60% Passage	Avg. Flow (kcfs)	Survival to LGR	Mid-60% Passage	Avg. Flow (kcfs)
June 1	0.404	6/9-8/2	83.1	0.359	6/28-7/9	38.1
June 8	0.386	6/24-8/16	57.4	0.188	6/30-7/22	39.6
June 15	0.315	7/5-8/20	47.3	0.148	7/4-8/11	35.2
June 22	0.277	7/30-9/1	38.0	0.093	7/18-9/3	28.0
June 29	0.193	8/4-9/28	29.8	0.051	8/10-9/20	23.6
July 6	0.134	8/11-10/15	27.2	0.022	8/19-9/30*	22.4

*For July 6, 2000, release assume 80% date 10 days later than that of June 29 release.

Subyearling chinook survival from sites above pool to Lower Granite Dam tailrace,
1999 and 2000



9.6.1.2.2 Planning and Management of Available Water to Support Mainstem Flow Objectives

The RPA should treat the normative river hydrograph flow objectives as hard constraints and require that the Action Agencies use available water volume and operations and flexibility in the hydrosystem to meet the objective of a normative river hydrograph. One of the major flaws in the draft opinion is failure to provide the volumes of water needed to meet a normative river hydrograph.

9.6.1.2.3 FCRPS Reservoir Operations to support Mainstem Objectives

The RPA should be modified to specify that reservoirs be operated according to the *CRITFC 2000 River Operations Plan*, which calls for implementation of Var Q and modification of flood control rule curves for Lake Roosevelt. These reservoir operations are necessary in order to provide flows consistent with the normative hydrograph.

With respect to moving flood control from Libby and Hungry Horse to Lake Roosevelt (Var Q), regional analyses indicate that maintaining higher elevations at Lake Roosevelt for flow augmentation and protection of tribal cultural resources will be inadequate. This will exacerbate the flow fluctuations in the Hanford Reach for juvenile migrants as well as listed species, and run counter to the recommendations of NMFS, the USFWS, CRITFC and the state fishery agencies to have steadily increasing flows during the emergence and migration of Hanford Reach Fall Chinook.

In the draft opinion, it is unclear how extensive system flood control shifts are suggested, and what would be the benefits, given the overly conservative flood control policies currently in place. Such a

shift occurred during 2000 reservoir operations and caused Grand Coulee to miss refill by 10 feet. The amount of extra flood control storage needed at Grand Coulee in order to implement VarQ operations at Libby and Hungry Horse is not quantified in the draft opinion with respect to, among other things, volumes and percent of storage space. This must be carefully examined before VarQ is implemented to evaluate impacts on Grand Coulee refill.

This action also has the potential to adversely affect both the spring and summer flows for salmon and creation of a normative hydrograph. The RPA should be modified to require implementation of flood control modifications that allow for both VarQ and higher storage elevations at Lake Roosevelt for salmon flows.

Implement Seasonal Drawdowns

The RPA should be modified to include the following: Implement an experimental drawdown of Lower Granite Reservoir to elevation 723 by June 20, 2001 to augment the declining Snake hydrograph and to improve critical rearing habitat and passage for subyearling fall chinook. Do not fill the reservoir until October 31, after adult migrants have passed upstream of the reservoir. Drawdown and maintain John Day and McNary reservoirs to plus or minus 1.5 feet of minimum operating pool from March 20-October 31. Operate the remaining Lower Snake reservoirs at Minimum Operating Pool until November 1.

Biological rationale: Drawing down these reservoirs will improve critical rearing habitat and expedite water particle travel time and passage survival. Operating pools at MOP will reduce water particle travel time, facilitating juvenile and adult passage. Heat transfer analyses indicate that Lower Granite drawdown will make limited cool water releases from Dworshak more effective, and better meet temperature water quality standards. Radio telemetry studies indicate that Lower Snake River adult passage does not appear to be impacted when fishway entrances are at MOP (Bjornn, 1997, unpublished data).

9.6.1.2.4 USBOR non-FCRPS operations for mainstem flows

The RPA should be modified to require USBOR to provide 250 kaf of storage from Banks Lake in the near term (1-3 years) and 500 kaf of storage from Banks Lake in the long term (5-8 years).

9.6.1.2.5 Non-Federal operations coordinated with FCRPS and USBOR Projects to Support Mainstem Flow Objectives

In the recommendations to the NWPPC 2000 Fish and Wildlife Program, CRITFC recommended that IPC contribute an additional 500 kaf from Brownlee Reservoir, and that BPA purchase an additional 1 MAF from Canadian sources. The draft opinion should be modified to reflect these changes.

9.6.1.2.6 Measures to evaluate and adjust the amount of water available to support flow objectives

The draft opinion calculates that of the 13.5 maf water diverted from the 31 U.S. Bureau of Reclamation (USBOR) projects for irrigation above McNary Dam, about 6.5 maf is consumed and not returned to the river. Although the draft opinion states that these irrigation depletions are a “major impediment to meeting NMFS’ flow objectives” and demonstrates that without these depletions that monthly flow targets could be met at a significantly higher rate, it is assumed that even if USBOR

discontinued delivering water for irrigation, “it is unlikely that all released water would remain in-stream [because] private diversions would probably capture some fraction, perhaps most of the water.” Based on this assumption, NMFS concluded that USBOR project operations are not likely to jeopardize the 12 listed ESU’s. The RPA on page 9-53 should be broadened to require USBOR to increase water supplies for flow augmentation. The draft opinion should also require that the USBOR acquire at least 0.5 MAF of additional water over the current amount of 0.427 MAF in the upper Snake River by 2001, and an additional 1.0 MAF by 2005.

The draft opinion needs to identify additional water sources for salmon in other Columbia River reservoirs. For example, the opinion needs to mandate the use of additional Canadian storage for fish flows identified in 1995 BiOp Sections 1C and 1D. Section 1C of the 1995-1998 Biological Opinion states “The COE shall implement for 1996 and beyond the 1.5 MAF reallocation of flood control from Arrow to Mica...” and Section 1D “The BPA and COE shall continue attempting to expand current arrangements for storage in Canadian Reservoirs to allow additional storage for fish flow enhancement, above the current approximate 1 MAF realized in current operational agreements.” According to the 1995 opinion, these improved operations at Arrow, including a 20-ft summer draft, could provide an additional 3.5 maf of flow augmentation.

The draft opinion should require BPA to fund installation of 2 turbines at Mica and Revelstoke dams in Canada, which is estimated to provide 1-2.4 MAF for summer flow augmentation. This installation should be finalized by the 2003 juvenile migration. In the meantime, BPA should purchase flood control storage space in Canada to allow for more storage in U.S. reservoirs for salmon augmentation water.

The draft opinion needs to mandate additional Snake River water identified in 1995 BiOp Section 1B which requires the USBOR to “firm up” commitments for the current 427 kaf from the upper Snake River, and “to secure an additional amount of water” as necessary to reduce impacts on the Snake River ESU’s.

The RPA should dedicate the 427 kaf from the upper Snake to meet flow objectives during July and August (not April through August as stated) because of greater flow needs during the summer months, and the need to conserve limited amounts of cool Dworshak water for temperature control. An additional requirement of the USBOR should be to pass all of the 427 kaf through Brownlee Reservoir as needed for fish flows. In the past, under an agreement between the USBOR, IPC, and Bonneville Power Administration (BPA), up to 160 kaf of water from the upper Snake is provided from Brownlee Reservoir (“shaping operation”) because of reservoir water quality issues in Cascade and Dogwood reservoirs (Payette River) and power revenue loss (from spill) at IPC upper Snake projects. The result of these shaping operations is reduction of available water volume in Brownlee Reservoir that otherwise could be used to meet the flow objectives. The shaping provision in Section 9.6.1.2.5 therefore should be deleted.

The BiOp should include an RPA requiring the USBOR to examine water spreading at all basin projects under their authority, and curtail all unauthorized use of water by 2003. For example, the Columbia Basin Institute (1994) identified 800-1000 kaf of the 2.8 MAF being diverted by the Columbia Basin Irrigation Project as illegal and/or wasted withdrawals by irrigation districts.

The USBOR and Corps should reexamine flood control rule curves and “carry over” water for all federal storage projects in the upper Snake Basin. Together, these agencies have flood control authority

for 3.368 MAF of active water storage (Corps 1991). From 240 to 600 kaf of this “carry over” storage is available for salmon flow augmentation if the water is released in late summer and early fall and routed through the Hells Canyon Complex in a timely manner (Reclamation 2000). Current management retains much of this carry-over storage until November and December when this storage is released for flood control. Management should be modified to release this water in late summer and fall to assist salmon migrations.

Mainstem withdrawals.

The RPA should reinstate the moratorium on withdrawal of additional water from the mainstem Snake and Columbia Rivers. The river is currently over-appropriated with respect to the needs for salmon flows and recreation of a normative hydrograph. For example, the Washington Department of Ecology released the mainstem water withdrawal moratorium and currently Ecology has over 430 applications pending to withdraw water from the mainstem Columbia. The relationship between flow, survival and fish productivity was noted above in these comments under section 9.6.1.2.1.

Dworshak Hatchery Operations.

The draft opinion should require the Corps to complete modifications to provide for independent water supply to the hatchery by the 2002 migration season.

Dworshak Reservoir Operations.

The Corps’ and NMFS’ current management of Dworshak without government-to-government consultation with the Nez Perce Tribe is contrary to the Secretarial Order and impairs fish stocks. The volume of cool water is limited in Dworshak; not enough is available to provide for the entirety of the Snake River juvenile and adult migrations. The draft opinion should follow the Nez Perce Tribe and State of Idaho plans for the use of Dworshak water for flow augmentation and selective withdrawals for cooling the river. For Dworshak, no quantitative summer flow values are listed. As discussed earlier, we maintain that a portion of the annual summer draw down to msl 1520 feet should be reserved for returning adults and the remaining 40% of the Clearwater juvenile fall chinook that are still migrating through the Clearwater and Lower Snake.

To make the most judicious use of Dworshak water for temperature control, a tri-level thermograph system data in the Lower Granite pool should be used to regulate the timing and volume of Dworshak releases. Data from this system should be obtained in real-time and made accessible to managers via the Corps’ Water Management Branch. The data should be used in temperature models for predictive management, instead of using exclusive data from the single forebay temperature monitor that fails to provide a holistic perspective of temperatures in the Lower Granite pool. NMFS’ call for Dworshak water in July is counter to tribal operations that balance limited water between juveniles and adults. NMFS’ use of Dworshak cool water in July retards growth necessary for ESA-listed Clearwater fall chinook to achieve timely smoltification and migration. NMFS’ management selects against this stock.

The Lower Clearwater River is an important producer of Snake River fall chinook salmon, which are now listed under the Endangered Species Act. The numbers of spawners have been increasing in recent years. Flows released from Dworshak Reservoir must address the 110% total dissolved gas

standard for the Clearwater River, and must also accommodate temperature needs for the rearing and smoltification of listed fall chinook salmon produced in the Lower Clearwater River. Releasing 48 – 50 degree Fahrenheit water in the summer from Dworshak Dam to reduce Lower Snake water temperatures drastically reduces temperatures in the Lower Clearwater River, affecting growth rates and migration timing of fall chinook produced in the Lower Clearwater River. Additionally, these releases are likely causing other ecosystem impacts, possibly to the species composition and density of aquatic macro invertebrates, an important food source for subyearling chinook.

The federal government must develop a solution to water temperature exceedences in the lower Snake River that does not rely solely on spill at Dworshak. Once again, hydro operation aimed at adjusting for non-normative conditions created by a dammed Lower Snake River, causes impacts elsewhere in the basin. The federal agencies have identified such options, including breaching the four lower Snake River dams.

The federal action agencies should prioritize the use of Upper Snake/Brownlee water for spring flow augmentation, and reserve Dworshak water for summer cooling. A VARQ flood control operation should be developed and implemented for Dworshak Reservoir, as well as for Libby and Hungry Horse Reservoirs.

Drawing Dworshak below elevation 1500 msl is not acceptable. Further, protection of tribal cultural resources exposed by additional drawdown is a prerequisite for any additional drawdown, beyond msl 1520. Corps regulations state that the Corps cannot drawdown Dworshak and expose cultural sites without consultation with the affected tribe and full mitigation. Implementation of drawdown without these prerequisites is counter to the Native American Graves Protection and Repatriation Act (NAGPRA), the Archeological Resources Protection Act (ARPA) and the National Historic Preservation Act (NHPA).

CRITFC recommends that NMFS require the Corps to operate Little Goose, Lower Monumental, and Ice Harbor dams within one foot of MOP from March 15 (not April 3rd) through October 31 (not September 30th) to fully protect the entirety of the juvenile and adult migrations. Also, the Lower Granite Project should be operated at msl elevation 723 feet from March 15 through October 31.

Flood Control Assessment

Recent NWPPC GENESYS model hydro studies conducted by CRITFC suggest that 3 MAF from the mainstem Snake and 5.5 MAF from the mainstem Columbia can be reclaimed from altered flood control operations and shaped into a normative hydrograph without significantly increasing flood risk to Vancouver and Portland. The GENESYS studies suggest that the normative hydrograph plan increases the average Vancouver-Portland risk of flooding, to 18% versus a 10% risk of flooding in the draft RPA.

Below are the specific reservoir elevations, at the end of each month, used in the GENESYS studies for the normative hydrograph. The elevations reflect reduced flood control and altered timing, in order to generate a higher late spring freshet. The operation shifts refill priority from late June to late May. Model results were disaggregated into daily time steps, in order to perform flood risk probability analyses.

Reservoir elevations used to Analyze Flood Control Risk

Elevation:	L. Brownlee Dworshak		
	Roosevelt		
December	1290.0	2077.0	1579.0
January	1290.0	2072.0	1568.0
February	1281.5	2067.5	1564.0
March	1274.5	2061.0	1558.0
April 1-15	1270.5	2056.5	1561.0
April 16-30	1280.3	2063.0	1573.5
May	1287.0	2077.0	1598.0
June	1290.0	2077.0	1600.0

NMFS should require the Corps to modify the overly conservative flood control operations that manage the Columbia at The Dalles in an average runoff year to 375 kcfs monthly average in June, or 100 less than bank full conditions, or about 200 kcfs less than flood flow conditions at Vancouver. The instantaneous peak should be managed to 450 kcfs. Utilizing the above analysis and other studies and information, an independent academic and/or engineering review should be conducted on the feasibility and the consequences of altering flood control operations to achieve an improved use of spring runoff for fish flows. This study should be accomplished by the 2001 migration to allow for modification of flood control. The draft RPA suggests a 2005 date for completion of this study. Given the extremely depressed state of basin stocks and degraded mainstem habitat, this date is much too protracted and should be modified so that the study is completed the end of 2002.

Floodplain Development

The RPA should be modified to call for restrictions to additional floodplain development without critical analysis and full environmental review as required under NEPA. Additional floodplain development will create political and economical obstacles to restoring critical mainstem habitat necessary for listed stock recovery.

Streamflow prediction.

The “NOAA River Forecast Center” should be correctly labeled, “National Weather Service’s Northwest River Forecast Center—NWRFC.” The draft opinion fails to identify or utilize the new hydro prediction model of the NWRFC, the NWS River Forecast System (NWSRFS), which is the new standard prediction model for the region. The draft also fails to identify or utilize SEUS—Snow Estimation Update System, which produces much better snow-pack information for the NWSRFS model. NWSRFS will have better long-term predictive capability to better manage the region’s reservoir volumes. The draft fails to specifically mention or utilize other advanced weather and climate diagnostic tools to help decision makers which include the 30 and 90 day NWS probabilistic climate forecasts, NWS experimental 12 month probabilistic climate forecasts, multivariate ENSO (El Nino Southern Oscillation) index, SOI values, NWS ENSO Risk Model, Pacific Decadal Oscillation research and prediction, sea-surface temperature departure analysis, Canadian Ensemble Forecast Model, and long-range models from the European Centre for Medium-Range Weather Forecasts.

Libby operations.

The RPA should be modified to require the Corps to expand predictive capabilities beyond the SOI diagnostic tool as the managing guide. A comprehensive package of climate diagnostic tools as mentioned above is needed and available to better manage storage and operations for all of the Corps' reservoirs.

9.6.1.3 Juvenile Fish Transportation

Screened Bypass Systems:

RPA 14 (1995-1998 Opinion) requires a reevaluation of existing screen bypass systems and evaluation of new or modified screened bypass systems (p. 122 Opinion). Evidence is mounting that screen systems may cause more juvenile mortality than turbine passage. Screen systems may also select against stocks such as sockeye and lamprey and life histories such as fry and subyearling chinook (Gilbreath et al. 1993; ISAB 98-4; ISAB 1999; IDFG 1997). The NMFS and the Corps are still proceeding with installation of screen systems at federal dams in the Columbia and Snake rivers. The Corps has failed to conduct the required evaluations for impacts of turbine intake screens on subyearling spring, summer and fall Chinook, including fry. In 1997 alone, an estimated 356,651 juveniles died at screen systems in the basin (WDFW, NMFS, ODFW 1997 Reports). Some of these mortalities were spring and summer chinook. Descaling by screens is a serious problem. NMFS biologists reported that 27% of descaled juvenile steelhead died at Bonneville Dam when held for 48 hours (CRITFC 1997b). Analyses by IDFG (1997) indicate that multiple passage through screen systems are correlated with the reduction of spring and summer chinook smolt-to-adult survivals.

Screens, especially extended length screens, perturb hydraulic flow lines into turbine intakes and reduce turbine efficiency (Wittenger, 1998 pers. comm). Smolts that are not guided by screens are forced through turbines at lowered efficiency, likely causing increased mortality rates (Bell 1991).

Evidence exists indicating that juvenile salmon injured and stressed from contact, hydraulics, and dewatering from screened bypass systems, and then concentrated at outfall release sites in dam tailraces, suffer significant predation from pikeminnows and avian predation. Piscivorous predators can temporarily hold in high velocity areas near outfall sites and can successfully engage in predation (Chapman and Witty 1993). Poe et al (1994) noted that predation downstream of screen system outfall pipes highly influences the survival of smolts that pass dams through screen systems. Studies indicate that most predation occurs in dam forebays and tailraces (Chapman and Witty 1993). Venditti et al. (1997) noted that slackwater in dam powerhouse forebays was likely responsible for radio-tagged Snake River fall chinook to reverse migration and swim a significant distance (14.4 km) upstream. Avian predators have been observed to be successful in preying on smolts concentrated at screen system outfalls (Jones et al. 1996).

Fish guidance efficiency (FGE) of screen systems is variable during the migration season. FGEs are typically low during the early part of the spring migration, then reach their highest level during the middle of the spring migration, then drop during the middle to the end of the summer migration (CRITFC 1997). Because the majority of FGE tests are during the middle of the spring and early summer migrations, FGE rates are inflated and not truly representative of the screen systems to divert salmon from turbine intakes.

Instead of spill, the 1995-1998 Opinion requires for screens to be left in turbine intakes to reduce adult fallback injury. This measure is still implemented despite a research review in that indicates that 40-50% of the thousands of adult steelhead that fall back through the screen systems at McNary dam suffer visible bruises from screen system passage (Wagner and Hilson 1991, CRITFC 1997b).

Despite independent scientific review of transportation (ISAB 98-2) that included:

1) a management approach to alternate between barging and leaving fish in the river throughout the migration season (i.e. “spreading the risk”), 2) calling for cessation of truck transportation, 3) placing additional emphasis on alternatives to transportation and, 4) questioning whether juvenile transportation can be made compatible with all life histories and stocks (i.e. transportation selects against certain stocks and species), the RPA continues to specify barge and truck the majority of salmon from all stocks, listed and unlisted. NMFS has not conducted any studies comparing the relative survival of in-river migrants with adequate spill and flow augmentation to collected and transported migrants, nor has NMFS examined adult returns for these groups. Nonetheless, NMFS transports between 70-85% of the Snake juvenile migration (FPC 1999 and 2000) and the RPA is calling for 100% transportation of all summer migrants. Further, in the 1998 FCRPS supplemental biological opinion, NMFS required that spring migrants not be transported from McNary Dam because no adults came back from juveniles that were transported from McNary. The RPA, however, still supports transporting 100% of the summer migrants from the same bypass system at McNary without confirmation that the system does not impact adult returns.

The draft opinion states that, “[d]uring the summer, flow is frequently below the biological flow objectives established by NMFS.” Why isn’t the flow objective met by the Action Agencies? Further, the draft opinion states that water temperature is frequently above water quality standards. How does removing the listed species from their critical habitat, improve their critical habitat? NMFS proposes tributary habitat improvement measures to mitigate for the lack of hydrosystem measures without requiring improvements to mainstem critical habitat, essentially asserting that salmon do not need mainstem critical habitat to support their life histories. This is a rationalistic, not scientific approach to species recovery.

The RPA calls for continued transportation of all subyearling chinook from McNary Dam. Yet the draft opinion notes that adult return data from juveniles that were exposed to the McNary extended screen bypass system and transportation indicates that there is an undetected problem with that system, and the RPA does not propose transporting yearling salmon and steelhead. Why does the RPA propose transporting any salmon from McNary until the undetected problem is resolved? Subyearling salmon have been shown to be more sensitive to screens and transportation than yearling salmon (CRITFC 2000 comments on NMFS’ White Paper on Juvenile and Adult Passage). Further, diverting and holding juvenile salmon in screen systems and transportation raceways that have higher water temperatures than the ambient river does not protect the beneficial use as required by the Clean Water Act. The RPA should be modified to require spill to the dissolved gas waiver be provided at McNary and all FCRPS dams to best protect all stocks and life histories of juvenile salmon and steelhead.

The RPA should be modified to abandon all trucking of juvenile salmon. Further, the RPA should be modified to require that turbine intake screens be removed from all dams until comparative research, using smolt-to-adult returns, conclusively indicates that screen bypassed salmon, barge

transported salmon and Pacific Lamprey are better served passing through screen systems than index-tested turbines operated within the 1% peak efficiency range.

Maximize in-river migration

The RPA should be modified to allow spring and summer juvenile migrants in-river rearing and passage in an improved in-river mainstem habitat using the other recommendations in these comments. Because no studies have been accomplished examining the differential survival of truck transported subyearling chinook and those allowed in-river passage via spill, there is great uncertainty with respect to truck transportation of these salmon, especially from the Lower Snake dams that are hundreds of miles from saltwater. In their comprehensive review of transportation, the Independent Scientific Advisory Board (ISAB) noted, "uncertainties associated with potential negative effects of transportation on genetic and life history diversity." (ISAB 1998).

Further, the ISAB noted that juvenile fall chinook should not be truck-transported, "because historical indications on truck transport are negative." (ISAB 1998). Further, it recommended that because of the uncertainties of transportation, trucking should not be the sole management regime for an entire stock (ISAB 1998). Trapping rearing juvenile fall chinook, starving them in the screen systems and trucks, and releasing them into the estuary before they are physiologically adapted to saltwater, may likely result in lower smolt-to-adult returns.

Reimers (1973) and Williams et al. (1996) note the importance of a rearing life history for subyearling fall chinook suggesting that this parameter is very important for survival and overall stock production. Lichatowich and Cramer (1979) found that the low coefficient of variation (high sensitivity) for measurements of time and size of the peak of the juvenile migration, facilitated by in-river migration into saltwater, suggested that this parameter is very important to stock survival and overall production.

In an independent assessment of transportation, Mundy et al. (1994) noted that the extended rearing life histories necessary to Snake River fall chinook made the practice of collection and transportation from Snake River dams a highly uncertain management practice. The Plan's recommendations acknowledge the fact that fall chinook production is sensitive to the proper time and size of juvenile migrants as they enter saltwater, which is best realized by in-river migration (Lichatowich and Cramer 1979; Reimers 1973).

Migrants should be left in the river to complete their freshwater life histories including reaching optimum size and timing into salt-water. Additional flows and spills in September should be provided to protect adult migrants from powerhouse passage and assist in minimizing energy expenditures to allow for successful spawning. These parameters have been found to be highly influential in promoting overall stock production (Lichatowich and Cramer 1979; Reimers 1973, Williams et al. 1996).

CRITFC opposes the high priority given to the proposed new fish transport studies (7 new transport studies in the lower Snake, mid-Columbia, and lower Columbia rivers). This is because both CRI and PATH analyses have shown that it is very unlikely that improvements in transportation survival will be adequate to meet NMFS's survival and recovery standards. While CRITFC and its member tribes do not support any transportation, the RPA should be modified so that, at a minimum, it follows the recommendations of the ISAB (1998) and requires the Action Agencies to provide good in-river conditions (spill and flow augmentation) to allow transportation and in-river migration to be meaningfully

compared. Any comparisons should include comparisons of smolt-to-adult survivals back to the spawning grounds. This remains a serious critical uncertainty that demands resolution.

The RPA should stipulate that the priorities for conduct of these studies and experimental designs be closely coordinated with the state and tribal fish managers and be subjected to review by an independent, scientific party.

9.6.1.4 Juvenile Fish Passage

9.6.1.4.1 Juvenile Fish Passage Strategy

Turbine Passage

As noted in Gilbreath et al. (1993), screen system passage can cause greater mortality than turbine passage. The RPA should be modified to state this and to include the following: maintain turbine operations at all dams within the 1% peak efficiency band from March 20-November 1 at the Lower Snake dams and from March 20- December 1 at the Lower Columbia dams and remove turbine intake screens to maintain the peak efficiency band. The RPA should also be modified to require that each turbine unit be hydraulically assessed (index-tested) and rated with an individual peak efficiency band – minimum servo-stroke to blade gate angle (not limited to “families of turbines as is now the case”) to optimize performance (Shelton 1982). Each turbine should be hydraulically assessed for structural repairs or modifications that will improve its individual efficiency to optimize performance. Turbine operations should be monitored via individual powerhouse automated monitoring systems on a real-time basis during the anadromous fish migrations to insure compliance with optimum performance to reduce and adult mortality. Reservoir tailwater fluctuations that can cause cavitation and poor turbine unit performance that increase salmon passage mortality should be significantly reduced

Full flow bypass

We support the RPA’s juvenile fish passage strategies and actions to maximize project survival through spill and surface bypass. We do not support collection, and powerhouse intake screen and bypass systems for these select against stocks and life histories (NWPPC 1999). These screen systems also incur 2-3 times greater direct mortality than spill and there is evidence that they are responsible for significantly greater delayed mortality to juvenile salmon than spill (see CRITFC SIMPAS modeling assumptions and CRITFC comments to NMFS 1999 Passage white paper). The RPA should require that reach and project-specific relative survival studies be conducted so as to compare mortality of juvenile and adult salmon passing through powerhouses with and without screen systems and with spill and surface bypass systems. Radio-telemetry methodologies should be prioritized because to be valid, PIT-Tag survival studies require underlying assumptions that cannot be met in the field. For example, the Anderson-Burnham model, the foundation of these studies, requires that treatment and “control” groups experience identical downstream environmental conditions (Burnham et al. 1987). Chi-Square goodness of fit tests between these groups often indicate that this assumption cannot be met, because groups are not detected at the same time at downstream dam detection points (Skalski 2000 pers. com.).

The RPA should require testing of a full flow bypass (without dewatering) to reduce stress and mortality of juveniles that occur from dewatering, holding, and handling. CRITFC recommends that the priority for this system to be tested, implemented and evaluated should be at the Bonneville 2

powerhouse. Evidence from PIT tag studies (NMFS Section 7 Consultation Passage White Papers) strongly suggests that mortality is increased for fish bypassed through screen systems at multiple projects. This mortality may be reduced by use of high flow bypass systems that move fish quickly through forebays and safely to tailwater without subjecting fish to the effects of dewatering, delay and handling in juvenile fish facilities.

9.6.1.4.2 Overview of RPA Actions Project-by-Project

The RPA should require spill operations outlined in the *CRITFC 2000 River Operations Plan*.

Juvenile spill

The *Plan* goal is to pass 90% of juvenile migrants over 100% of the migration through dams via spillways and sluiceways and other surface bypass systems. Ideally, controlled spill should be implemented for 24 hours a day, 7 days a week to the dissolved gas variance. General planning dates for spill should be March 20-September 30. Actual timing of spill should be determined by sampling at dams and in the river. Spills at this level should continue until 95% of the fall chinook migration has passed each individual dam as indicated by screen bypass indices, and hydroacoustic technology, and in-river sampling. The spill period should be April 1- September 15 for Lower Granite through McNary and March 21 through October 1 at John Day, The Dalles and Bonneville. During spring and summer fish migrations, we recommend spill for each dam based upon spill variances for total dissolved gas. Spill levels are expressed in total volume or percent of flow in spill (daily average flow or daf).

The RPA should require the Action Agencies to obtain flexibility for spill from the appropriate tribe and/or state water quality agencies in a manner to allow spill to be applied each year. Further, the RPA should allow the use of spill to meet passage standards of 90% fish passage efficiency through spill and surface bypass passage. Appendix E is the draft opinion supports this goal, as does the results of the last five years of in-river research (see Appendix E comments below). Flexibility to allow spill as an interim measure will protect salmon and steelhead habitat, one of the beneficial uses of these waterbodies, pending the timely implementation of measures designed to ensure compliance with the Clean Water Act at these facilities.

The RPA should also be modified to require that spill levels are hard constraints, not be abridged or violated for the sake of research or transmission deficiencies without the full consensus of the tribes and fishery agencies.

9.6.1.4.4 Project-by-Project Spill Requirements

The RPA should be modified to meet the following recommended spill levels. These levels should be adjusted upwards to conform to the increase in spill variances to 120-125% TGP:

Lower Granite-45 kcfs; 35% daf of for Little Goose, 50% daf for Lower Monumental, 75 kcfs for Ice Harbor, 120-160 kcfs for McNary, and for John Day 60% daf. Spill at The Dalles should be 64%. Spill at Bonneville should be to 120 kcfs or the dissolved gas waiver limit.

Biological Rationale: Spill has been shown to offer the best protection for juvenile migrants and to speed their migrations through the hydrosystem corridor (CRITFC et al. 1994; STFA 1995) and is consistent with the normative river approach (Williams et al. 1996). For example, without spill, the low guidance efficiencies for subyearling fall chinook at the Lower Snake dams force about 50% of migrants to turbine passage. NMFS pit-tag studies indicate that very few, if any, of the migrants that are subjected to turbine passage survive through the Snake River (Smith et al 1997).

Spill for Adult Migrants

After 98% of the juvenile migration has passed a dam, The RPA should specify that spill is continued but modified for adult passage. The end spillbays next to the adult ladders should be opened to spill 1-3 kcfs each for adult attraction to the ladder entrances. Further, endbay spill and continued sluiceway and/or surface bypass operation provides a vital downstream passage route for many adult fall chinook and steelhead that fall back over dams. This operation should continue until November 1 at the Lower Snake dams and until December 1 at the Lower Columbia dams, and has been recommended in the past by FPAC (1994) and the fishery managers (DFOP 1993).

Biological Rationale: The direct take of listed and unlisted fall chinook and listed steelhead that fall back through screens system and turbines has not been addressed by the federal government (CRITFC 1999). At McNary Dam alone, 7,000-11,000 steelhead were documented to fallback through the screen bypass system (Wagner and Hilson 1991). Wagner and Hilson (1993) noted that over 7,000 steelhead fell back through the McNary Dam powerhouse. Of adults observed in the screened bypass system, they noted that 39% of them had visible bruises. NMFS (1995) noted a direct kill of 41% of adult salmon that passed through a Kaplan turbine. Evans and Beaty (2000) noted that about 30% of spring steelhead fallbacks were kelts heading to sea. Loss of adult migrants through powerhouse fallback selects against population abundance and genetic diversity.

Including the above specifications and criteria in the RPA is consistent with the draft opinion's passage strategy to maximize spillway passage, which has been shown to provide the highest survival of any passage route.

The Dalles Spill

As documented in letters from the states and tribal fish agencies submitted to NMFS, the draft opinion should maintain 64% spill at The Dalles established by the 1995 FCRPS Biological Opinion. There is no sound scientific basis for decreasing spill to 40%. The proposal to reduce spill at The Dalles is contradictory to the draft opinion's juvenile fish passage strategy, "[t]hese changes are expected to improve inriver survival of all juvenile salmon migrants by reducing passage through turbines," and "[t]he greatest proportion of the survival rate increase is expected as a result of the RPA spill changes expected at The Dalles Dam." Decreasing spill will in fact, reduce spillway passage and may reduce project survival because of the greater passage of smolts through turbines and the sluiceway. The RPA is based on survival studies conducted at The Dalles 1997-1999, but as documented in letters from the regional fish agencies and CRITFC, there were serious flaws in the study design including:

- The study design did not examine the relative survival of passage through turbine routes.
- The treatment groups were not handled in similar fashion.

- The test conditions were based on the percentage of total flow passing through spillways, and not on actual volume of spill.
- The results of the studies were equivocal.
- There were no statistically significant differences in survival between the different spill percentages tested.
- The point estimates of survival seemed to indicate that the benefit was more likely in summer migrants than spring migrants.
- The key protocol for robustness in the study design that groups were well mixed and arrived at Bonneville at the same time was not met.
- The study did not examine delayed mortality or the effect of the individual passage routes on smolt-to-adult returns.

The RPA calls for an evaluation of 40% spill (9.6.1.4.4, page 9-73), a level that was not tested in the passage survival studies. There is no direct evidence that reducing spill to this level will improve either spillway or project survival. In Section 9.6.1.4.5, page 9-78, additional studies of The Dalles Dam passage routes are called for, which are intended to resolve the question of spill level and relative survival through various passage routes. The draft biological opinion should assume no increased spillway or project survival at The Dalles Dam until research resolves experimental design issues and provides statistically significant survival estimates.

CRITFC concurs with the comments submitted by the Fish Passage Center (DeHart 1999) detailing potential flaws in The Dalles Dam Survival Study. They are as follows:

- The NMFS survival study at The Dalles Dam does not support the conclusion that spill should be reduced from 64% to 30%. This is in large part because the test condition is not adequately defined in the test relative to the mortality mechanisms that are hypothesized to occur. The NMFS analysis is not adequate to determine an optimum spill condition or a change in spill measure.
- The 1998 test of 30% versus 64% in the spring of 1998 did not produce statistically significant differences in survival among spillway or sluiceway at 64% or 30%. The 30% versus 64% condition was only tested in 1998 under 1998 conditions.
- Although a statistically significant difference occurred in the summer period test of the 30% versus 64% condition, fish utilized in the test came from two separate sources. Test fish in the first half of the test were collected at Bonneville Dam and transported upstream, 45.5 miles to their release at The Dalles and the fish in the second half of the test were collected at McNary and transported 100 miles to their release point at The Dalles. While the composition of the samples may be the same regardless of whether they are collected at Bonneville or McNary dams, the samples certainly differ physiologically between the two collection points. Review of the data shows that the lowest survivals occurred in the second half of the test.
- We reviewed the 1997 test results for summer migrants, relative to the volume spilled. It appears that survival averaged 84% for groups, which passed in spill volumes less than 200 kcfs, while survival averaged 98.3% for the groups passing in spill volumes above 200 kcfs.

- A detailed analysis of spring 1999 data showed a pattern of increasing survival among 3-day blocks of releases suggesting a handling effect that would bias results.
- We also found a consistently higher recapture proportion for daytime releases than night-time release groups having more to do with operations at Bonneville at the time when fish arrived at that downstream project, than any operations at TDA.
- Travel time analysis of Spring 1999 groups showed that arrival at Bonneville was always protracted for test fish compared to reference release groups. This suggests differences in the distribution of these migrating groups that would violate the assumption of homogeneous migrating conditions for reference and test fish.
- We found the grouping of coho and spring chinook in release groups to be inappropriate as well because their recapture probabilities were significantly different, especially when time of day of release was taken into consideration. The proportion of coho used in each group varied seasonally (with generally low numbers early in season, higher numbers as coho increased then declined again as coho numbers decreased). Also, relative proportion of coho varied between forebay and tailwater release groups within a given release date.
- We found travel time of run-at-large fish detected at both John Day and Bonneville dams was 6-10 hours shorter than mean travel time for test fish through this reach than we would expect based on rate of travel of run-at-large fish traveling the same reach.

9.6.1.5 Effectiveness of Juvenile Salmonid Passage

Bonneville I extended screens

The RPA assumes an increase in FGE and bypass survival with installation of extended length screens at Bonneville I. Installation may be deferred indefinitely due to the high cost of the screens and modification of the bypass system (over \$120 million). Installation would also be dependent upon, 1) passage results of a surface bypass system, which will require years to develop, and 2) resolution of Bonneville II bypass outfall issues.

The following are examples of these problems:

- It has to be ensured that current passage routes, such as screen bypass systems- especially extended screens, do not impact other native species such as lamprey, sturgeon, bull trout, etc. If these systems have negative impacts then installation may not be implemented. This delay and possible non-installation, will affect the perceived benefits these systems have for the hydro system's calculated improvement.
- Fry research. How do fry interact with screen bypass systems, especially extended screens ? If there is a negative impact, these systems need to be modified or removed. This will impact the perceived benefits that have been calculated for the hydro-system.

- Reduction of flows up the gatewell to reduce fish injury and mortality may be needed at the screen bypass system. This reduction of flows will reduce FGE, which in turn reduces the benefit that these systems are estimated to generate. How does this fit into the hydro-system improvement and jeopardy decision? There is no discussion in the draft RPA as to how to rectify this, or even acknowledgement that this is a serious, potential problem.

Given these problems, the draft RPA should be modified to abandon installation of these screens in favor of spill and surface bypass development to best protect life history diversity and all stocks, a position consistent with the recommendations of the ISAB (NWPPC 1999)

Bonneville II FGE improvements

According to the RPA, Bonneville II FGEs are estimated to increase 25-40% from improvements in intake flows and screen performance. However, these increases are based solely on hydraulic models and lack verification from field prototype studies. Estimated increases in FGE also disregard screen effects on fish condition and survival.

The following are examples of these problems:

- It has to be ensured that current passage routes, such as screen bypass systems, especially extended screens, do not impact other native species such as lamprey, sturgeon, bull trout, etc. If these systems have negative impacts then installation may not be implemented. This delay and possible non-installation, will affect the perceived benefits these systems have for the hydro system's calculated improvement.
- Fry research. How do fry interact with screen bypass systems, especially extended screens ? If there is a negative impact, these systems need to be modified or removed. This will impact the perceived benefits that have been calculated for the hydro-system.
- Reduction of flows up the gatewell to reduce fish injury and mortality may be needed at the screen bypass system. This reduction of flows will reduce FGE, which in turn reduces the benefit that these systems are estimated to generate. How does this fit into the hydro-system improvement and jeopardy decision? There is no discussion in the draft RPA as to how to rectify this, or even acknowledgement that this is a serious, potential problem.

Given these considerable problems, the RPA should be modified to abandon installation of more screens at the second powerhouse in favor of spill and surface bypass development, a position consistent with the recommendations of the ISAB (NWPPC 1999)

The Dalles Improvements

The RPA speculates a 8-10% increase in system-wide FCRPS survival for subyearling and yearling migrants. This is based upon a 8-10% increase in spill passage survival at The Dalles, which is assumed from decreasing spill from 64 % to 40%. As discussed in the section above, there are no statistically valid data to support this assumed increase in systemwide survival based upon survival

increases at The Dalles. Further, additional analysis is needed to corroborate research findings from 1997-1999. Preliminary results of The Dalles 2000 juvenile survival study indicate that many juvenile migrants are forced through the turbines when spill is reduced from 64% to 40%. In addition, the impacts of delayed mortality from non-spill passage, with respect to smolt-to-adult returns, has yet to be evaluated. Considering that Gilbreath et al. (1993) noted that delayed mortality to juveniles that pass through turbines can be four times greater than delayed mortality from spill passage, it is important that this critical uncertainty be rigorously tested. The RPA should be modified to require 64% spill at The Dalles until smolt-to-adult returns can be evaluated from survival studies.

John Day Passage Improvements

The BiOp contains extremely optimistic assumptions regarding installation and effectiveness of juvenile screen bypass improvements and spill programs. We believe that these assumptions have resulted in overestimates in survival improvements from the RPA. Specifically, the RPA assumes an increase in fish guidance efficiency (FGE) (from 73%- 82% for yearling and 32 to 60% for subyearling fish) at John Day Dam with installation of extended-length screens and new vertical barrier screens. We do not believe this is reasonable. There are many engineering, hydraulic, and biological issues that would need to be resolved for extended length screens to be installed. For example, if unacceptably high rates of salmon mortality and poor conditions continue to persist in future vertical barrier and extended screen tests, very expensive and time consuming modifications to gatewell orifices (including relocation) may need to be made in addition to the estimated \$85.6 million to install screens. These likely problems and high costs would result in a decision to delay or defer installation of extended screens at John Day Dam.

The following are examples of these problems:

- It has to be ensured that current passage routes, such as screen bypass systems, especially extended screens, do not impact other native species such as lamprey, sturgeon, bull trout, etc. If these systems have negative impacts then installation may not be implemented. This delay and possible non-installation, will affect the perceived benefits these systems have for the hydro system's calculated improvement.
- Fry research. How do fry interact with screen bypass systems, especially extended screens ? If there is a negative impact, these systems need to be modified or removed. This will impact the perceived benefits that have been calculated for the hydro-system.
- Reduction of flows up the gatewell to reduce fish injury and mortality may be needed at the screen bypass system. This reduction of flows will reduce FGE, which in turn reduces the benefit that these systems are estimated to generate. How does this fit into the hydro-system improvement and jeopardy decision? There is no discussion in the draft RPA as to how to rectify this, or even acknowledgement that this is a serious, potential problem.

Given these concerns, the draft RPA should be modified to abandon installation of these screens in favor of spill and surface bypass development and to protect all stocks and life histories, a position consistent with the recommendations of the ISAB (NWPPC 1999).

John Day Drawdown

The RPA should be modified to require the Action Agencies to fund Phase II of the John Day Dam Draw Down Study, which would include a complete environmental impact statement (EIS). The USFWS and NMFS should be co-lead agencies on this EIS. The Corps' conclusions for Phase I of the John Day Dam Drawdown Study were biased and scientifically and economically flawed (CRITFC 2000). For example, the Corps failed to include the results of the Mid-Columbia Quantitative Analysis Report (QAR; Cooney et al. 2000). The QAR noted that lower river federal project survival improvements could significantly improve recovery of listed salmon. For listed upper Columbia steelhead and spring Chinook, the QAR noted that these ESUs would require survival improvements from 20-50% from measures in the lower Columbia to meet NMFS' requirement for risk/recovery. The RPA should specify that the Action Agencies fund the EIS beginning in 2001 with a final EIS and Record of Decision due by the end of 2004.

McNary Improvements

The RPA should be modified to require, 1) that spill efficiency and improvements in spill volumes and spill patterns should be rigorously tested at McNary, and 2) that the turbine intake screens should be removed as SAR data indicates the screens are causing significant direct and delayed mortality to listed salmon. The existing screen system continues to cause impacts to anadromous fish that remain unresolved. The following are examples of these problems:

- It has to be ensured that current passage routes, such as screen bypass systems, especially extended screens, do not impact other native species such as lamprey, sturgeon, bull trout, etc. If these systems have negative impacts then installation may not be implemented. This delay and possible non-installation, will affect the perceived benefits these systems have for the hydro system's calculated improvement.
- Fry research. How do fry interact with screen bypass systems, especially extended screens? If there is a negative impact, these systems need to be modified or removed. This will impact the perceived benefits that have been calculated for the hydro-system.
- Reduction of flows up the gatewell to reduce fish injury and mortality may be needed at the screen bypass system. This reduction of flows will reduce FGE, which in turn reduces the benefit that these systems are estimated to generate. How does this fit into the hydro-system improvement and jeopardy decision? There is no discussion in the draft RPA as to how to rectify this, or even acknowledgement that this is a serious, potential problem.

Given these considerable problems, the draft RPA should be modified to require removal of these screens.

Lower Snake Projects Improvements

The RPA should be modified to require, 1) spill efficiency and improvements in spill volumes and spill patterns should be rigorously tested at the Lower Snake dams, and 2) the turbine intake screens should be removed as SAR data indicates the screens are causing significant direct and delayed mortality to listed salmon.

Lower Snake Project(s) Breaching

The RPA should be modified to require the Action Agencies to fund construction and mitigation planning for breaching the four Lower Snake dams in a timely fashion with the following schedule: Lower Granite and Little Goose breached by 2008; Lower Monumental and Ice Harbor breached by 2010.

In-Season Spill and Temperature Management

While NMFS has been the agency that has requested a spill waiver since 1994, the Corps has been the agency that has regulated spill levels. We support the RPA requiring the Action Agencies to submit water quality variances for temperature and dissolved gas to the state water quality agencies. The RPA should be modified so that failure to obtain the variances would require reinitiating consultation and issuing a jeopardy opinion.

The extant system temperature and dissolved gas monitoring system rely on point estimates, which are not representative of the forebay and tailrace conditions in many situations.

The continued use of the forebay monitors is most problematic. The levels of spill that NMFS assumes for the RPA are those that yield a 120% reading at the tailrace monitors. However, in 2000, most of the adjustments of spill have been done on the basis of the forebay monitor at the next downstream project, or in some cases further downriver than the first project. The result was the implementation of a less effective spill program than assumed in the 1995-1998 FCRPS biological opinion. The relationship between gas and temperature is defined such that increases in temperature yield increases in total dissolved gas in solution. The forebay monitors often report localized high readings of total dissolved gas due to increased temperature from the presence of the dam. The temperature in the forebay is affected by the local solar heating that occurs on the surface. Often the forebay monitors indicate levels above 100% TGP even when no spill is occurring upstream in the hydrosystem.

NMFS should make every effort to obtain the flexibility necessary to achieve an 90% FPE objective. This would require NMFS to further review current research and monitoring regarding the efficacy of utilizing current measurements and its impacts on the RPA spill program during years when spill levels are manageable.

The RPA should be modified to require the Action Agencies to fund the installation and maintenance of a tri-level thermograph network, capable of instantaneous data access via the internet for the entire Columbia below Chief Joseph Dam, based upon the existing Snake River system.

9.6.1.4.6 System or General Studies (including research, monitoring and evaluations)

The RPA should be modified to implement the following studies, monitoring and evaluations, funded by the Action Agencies, in consultation with the tribal and fishery agencies:

- Abandon work on turbine intake screen systems.
- State-of-the-art hydroacoustic systems and robust evaluation of spill efficiency should be conducted on all eight Corps dams.
- Incorporate a system-wide analysis of all adult fishways and prepare to make improvements on deficiencies.
- Modify adult telemetry studies by reducing sample sizes, account for the fate of each adult, and evaluate spawner distribution and spawner success. Publish final reports.

- Examine new fishway designs that stimulate leaping and are more adult energy efficient than current designs (Orsborn 1987).
- Investigate adult and juvenile passage over and through Dworshak, Grand Coulee and Chief Joseph hydroprojects.
- Evaluate the relative direct and delayed mortality of juvenile passage with SARs through turbines, screens, spill and surface bypass at all dams with these facilities.
- The Action Agencies should fund 24 hour, seven day a week fish counts utilizing state-of-the-art video methodology.

9.6.2 Adult Salmonid Passage

The RPA measures are expected to decrease adult losses through the FCRPS by 25% over the next 10 years, which the RPA estimates will improve adult survival 0.8-11.4% for 10 ESU's. The draft opinion, however, fails to justify these estimates. Although the draft opinion includes a comprehensive action list of adult passage evaluations and operational and maintenance measures (many of which are ongoing actions), it is highly unlikely that adult passage losses can be significantly reduced without major structural changes and modified operations to the dams/fishways. For example, CRITFC has recommended that flow augmentation, selected spill and surface bypass be implemented to protect kelts and adult migrants that migrate in early March and September – November, because powerhouse passage, with screens and turbines causes significant injury to adults that migrate downstream (see CRITFC comments on past opinions and the *2000 River Operations Plan*). These, however, are not included in the RPA. The draft opinion must provide specific and quantitative analysis as to how the proposed adult passage actions can reduce adult losses, increase spawner distribution and spawner success to increase stock productivity.

The current estimates of just over 2% mortality per project are based on radio telemetry data that examines survival of the adults from below Bonneville to the head of Lower Granite and to the Mid-Columbia. The utility of using these adult telemetry studies to estimate survival in the Mid-Columbia has been recently opposed by the NMFS science center because of unaccounted losses of tags, inadequate sample size, tag detection problems and other methodology problems. These studies do not investigate mortality that may occur after leaving Lower Granite Pool and entering the tributaries. Furthermore, these studies lack evaluation of spawner success and they assume no mortality from Lower Granite pool or of the upper Columbia tributaries to adult spawning success. For these and other reasons, the NMFS estimates for adult survival are likely inflated and lack robustness.

CRITFC has continued to recommend use of dam counts for adult survival because they have a historical record, and include the entire migration. CRITFC recommends using both telemetry and dam counts to estimate adult survival because together they provide more robust estimates (CRITFC 2000). The RPA should be modified to incorporate this approach to estimate adult survival through the FCRPS.

Spawning studies done in Canada have shown that the amount of energy an adult needs to reach the tributaries is only half of the energy required to achieve successful spawning (Information and sources outlined in Meas & Geist, 2000 AFEP Proposal). Thus, adults may survive to the spawning gravels but lack the energy reserve to complete the spawning cycle. Further, adults may lack the energy reserves to properly distribute themselves into better quality spawning areas. NMFS must include in the RPA the study the energy expenditure of adults and spawner distribution and success before NMFS disregards

conversion rates and decides that current telemetry estimates are the sole technique to evaluate adult survival and passage success. This is too important an issue for unfounded assumptions.

The radio telemetry studies suggest that travel times for adults is the same through the reservoir systems as it is in a free flowing section of river. However, the studies indicate that adult passage through the dam takes extra time and likely extra energy (Peery et al. 1998; Sturehenberg et al. 1994). These findings were generated through comparisons between adult median travel times through the Hanford Reach and median passage times through the Priest and Wanapum dams and reservoirs (Peery et al. 1998).

The RPA asserts that there is little or no difference in migration times whether the fish pass over the dams and through the reservoirs or in tributaries. This statement ignores impacts to adults spending longer times in poor water quality than under historically cleaner conditions. The FCRPS exhibits higher water temperatures for extended periods of time, whereas the historical system was flashier with regards to temperature (Karr et al., 1998). Historically, there was a rapid temperature increase followed by a rapid cooling. This peak usually took place at the end of July and into the middle of August. Historically, adult runs were timed to avoid that time period. Few if any adults were in the river system at the times of these peak temperatures. By altering the shape of the temperature regime, we have increased the exposure of adults to water quality-challenged water.

The studies cited in support of the survival estimates in the draft opinion did not include more recent years, since the draft reports have not been released. There is little discussion of how to improve the current hydrosystem for adults, let alone what the potential reductions in mortality might be.

Despite recommendations of the ISAB (NWPPC 1999) to place more focus on adult passage, the Corps continues to resist funding adult passage improvements. Many current adult fishways lack critical repairs and parts, and most juvenile bypass systems were not designed to safely pass adults. For example, 100-200 adults are routinely trapped at the John Day juvenile monitoring facility and cannot be liberated unless the juvenile system is shut down, a procedure that neither the Corps nor NMFS cares to implement on a regular basis. As another example, 8,000-10,000 adults every year fall back through the McNary Dam powerhouse and juvenile bypass system and suffer significant injuries in the process (CRITFC 2000).

Based on the flawed assumptions related to adult survival estimates for the baseline conditions, the lack of specific, quantitative measures to increase survival, spawner distribution and success, and the historical lack of commitment by the Corps to fund adult passage improvements, CRITFC finds the RPA for improvements for adult survival completely speculative and unreliable for determining changes in the average population growth rate or meeting the jeopardy standard.

Section 6.2.4.1.1. Downstream Migrating Adults (Kelts)

The draft opinion states, “[I]n 1994, 47 wild steelhead kelts passed downstream via the juvenile bypass system at Little Goose Dam (Hurson et al. 1996).”. This data is not reliable. It is unlikely only 47 kelts passed the dam through the screen bypass at Little Goose in 1996. Ultrasound work has demonstrated that the visual methods utilized at Little Goose and other Snake River dams, prior to 2000, were erroneous. CRITFC recommends that NMFS delete this statement and replace it with the following:

Kelt identification and enumeration research conducted in 1999 demonstrated that the vast majority (0.85 ± 0.04 , 95% CI) of the 2,400 adult steelhead released from the separator at Little Goose Dam between 1 April and 30 June were kelts (Evans and Beaty, in review).⁹ This includes approximately 800 wild kelts, or about 10% of the wild, pre-spawn steelhead run counted crossing the Lower Granite Dam fishways. Additional enumeration work conducted at Lower Granite Dam's juvenile bypass during the period of March 26 to June 7, 2000 estimated that 96% (± 0.01 , 95%CI) of 4,182 adult steelhead removed from the separator were kelts (Evans and Beaty, in prep.). These fish represent about 18% of the wild, pre-spawn steelhead run counted passing Lower Granite fishways. As stated previously in these comments, the RPA should be modified to require adult spill and sluiceway operations to allow kelts and other adults a downstream passage route other than the powerhouse.

9.6.3 Habitat Actions

The RPA should be modified to restrict the Corps from any dredging activities that involve further deepening and associated degradation of critical mainstem habitat in the Snake or Lower Columbia Rivers. Further, the RPA should require the Corps, in full consultation and with approval from the tribes and fishery agencies, to conduct monitoring and evaluation and fully mitigate for the impacts of maintenance dredging in the Lower Snake and Lower Columbia rivers.

⁹ Evans, A.F., and R.E. Beaty. (In review) 2000. Identification and Enumeration of Steelhead (*Oncorhynchus mykiss*) Kelts at Little Goose Dam Juvenile Bypass Separator, 1999 Ann. Rep. To US Army Corps of Engineers, Walla Walla District, for Contract No. DACW68-99-M-3102. Prepared by the Columbia River Inter-Tribal Fish Commission, Portland OR.

System Actions to Improve Spill Capability

The RPA should be modified to direct BPA to purchase additional power to allow for the above spill program to be implemented for the 2001 and future fish passage seasons. The RPA should also be modified to require BPA to complete the Schultz-Hanford 500-kv line and to upgrade the West of Hatwai line by 2003. Further, BPA should complete a detailed assessment of additional transmission system upgrades that would allow implementation of these upgrades by 2005. The RPA should also require BPA to bring these RPA transmission system requirements into the Regional Transmission Organization (RTO) as non-firm transmission limitations.

Turbine unit operations

The Corps' Fish Passage Plan allows many excursions from the 1% peak efficiency criteria. Such excursions result in a lower juvenile salmon survival through turbine passage. The RPA should require the Action Agencies to operate FCRPS turbines according to criteria in the *CRITFC 2000 River Operations Plan* and the *1993 Tribes and Fishery Agency Detailed Fishery Operating Plan*. Further, the RPA should require the Corps to index test each individual turbine units, not "families" of turbine units throughout the FCRPS to maximize system turbine efficiency and reduce salmon mortality.

Evaluating turbine operation above the 1% efficiency range is counter to the bulk of scientific literature, the draft biological opinion, the 1995-1998 FCRPS Biological Opinion and the 1998 Supplemental Biological Opinion, which indicate fish suffer higher mortality through turbines operated outside of the 1% peak efficiency range. This section should be deleted from the RPA.

Comments on Appendix B Biological Effects Team

SIMPAS Model:

The SIMPAS model is not an adequate model to analyze juvenile salmon project or reach survival through the FCRPS. It merely gives a point estimate, or snapshot of a survival estimate, based upon several fixed parameter assumptions. Further, SIMPAS does not address delayed mortality through the FCRPS, because it fails to incorporate a life history analysis. This differs from the PATH approach, which is supported by CRITFC and the member tribes. In addition, SIMPAS does not incorporate flow regulation and is insensitive to biological effects of flow management. We offer the following specific critique of SIMPAS:

- SIMPAS is not flow sensitive. The model does not differentiate between low and high flow years, weekly or daily average flows. There is no mechanism to account for changing flows on a daily or even weekly basis throughout the salmon migration season. The model only uses seasonal average flows and proportions this flow into individual passage routes at each particular dam. This approach disregards the flow-survival relationship, strongly supported by NMFS and regional reviews including PATH and Cada et al. (1994). Unlike FLUSH, there is no accounting for water quality impacts in the SIMPAS or in the cumulative effects of increasing temperatures to juveniles as they pass the project. SIMPAS attempts to account for this by using reach survival data gathered for each water year simulated. Reach survival data from Snake River studies is utilized and extrapolated for Columbia River reaches. This data is suspect because there is uncertainty in the study's ability to meet critical assumptions such as adequate mixing of forebay and tailrace replicates. For the Lower Columbia River and other reservoirs where there is no reach survival data, a reach survival estimate is derived from an extrapolation of the Snake River survival data to the length of the lower Columbia project reservoirs.
- SIMPAS is limited to flow data from 1994 to 1999. All of these years except 1994 were average to above average flow years. Year 1997 is one of the highest flow years on record and 1996 and 1999 were both high flow years. Both 1995 and 1998 were both average flow years. However, 1998 was one of the coolest summers on record. Thus, the water years used in the analysis result in a biased estimate, considering the probability that in the ten years of the opinion, low, medium and high flow years will be normally distributed. This bias is more pronounced for the fall chinook analysis which only includes 1995 – 1999 water years.

In conducting alternative SIMPAS analyses, CRITFC employed a more representative technique, using a survival estimate for a low flow year, an average and high water year. To insure that all the data from 1994 –1999 was used in the analysis, each water year was placed in the appropriate category from low, medium, and high. Then an average survival for each water year category was calculated. This eliminated biasing the analysis by unequal weighting of water years.

- The estimates for pool survival are not adequate. CRITFC questions why the Biological Effects Team (BET), used a different technique than what was used by PATH in their analysis. PATH used the FLUSH model, which has a mechanistic methodology for fall chinook pool survivals and uses flow/travel time/survival relationships for the spring pool survival estimates. The advantage of this approach is that the reach-flow survival relationship has been validated in a life cycle

analysis approach (see above comments under Flow, Survival and Productivity). Further, PATH identified in-river survival as a key uncertainty in their modeling process. Accordingly, the PATH team suggested that “well-planned” experiments needed to be developed to answer questions about passage model assumptions, for individual reaches. These experiments have not been developed nor have the questions been answered by SIMPAS. Rather, NMFS has enveloped SIMPAS in assumptions, replacing any lack of data with “professional judgment”.

- Spill was evaluated for the years for which survival values were estimated (1994-1999). The actual levels of spill modeled for the draft opinion, and used as part of the validation for the no jeopardy assessment, may be based on levels of spill greater than what actually occur in the system under less than average, or near average flow years. The BiOp likely overestimates the benefits of spill based on the assumption that spill at each dam occurs up to the 120% gas waiver. In actuality, spill does not reach the 120% total dissolved gas level due to in river management being tied to the tailrace monitors and the 115% criterion. CRITFC staff attempted to estimate a better average for spill amount at the dams than the model in order to recalculate the base case survival estimates.
- The description of model calibration, using terms such as reasonable and similar, does not adequately describe either variability, the degree of uncertainty about the data generated by the model, or how well it fits the data used to calibrate it. Nowhere does NMFS show how the model was calibrated, or how well the data fit the calibration, nor was the model critiqued with independent peer review. Accordingly, it appears unwise to place any reliance on the model. How much weight would a reasonable person place upon an unknown structure or tool?
- Model assumptions are not tested. For example, survival estimates from Snake River are projected for the lower Columbia where data is not available. Thus, equal per mile survival is assumed for all segments of the river. No attempt is made to provide alternative analyses for other possible assumptions. For example, what if per dam survival is 10% higher or lower in the Lower Columbia? How would this affect the hydrosystem survival?
- All numbers in the model are treated equally, whether those numbers are empirical (based on reach survival estimates), calculated (derived by partitioning a survival estimate into parts for each parameter identified - NMFS uses a survival estimate from the Lower Snake River to determine a per mile survival, then projects that to the lower river projects)) or based on professional judgment. These numbers are placed together into an equation, and the end number used to determine if a group of assumptions can be improved upon by comparison to another group of assumptions.

The danger of this approach is that it gives a false sense that the data are all of uniform value and are reliable. This illusion is carried through to the point of developing hydrosystem survival for Snake River and Mid-Columbia ESU's for chinook and steelhead. But these endpoint survival numbers are point estimates and have a range that depends upon the RPA measure chosen. No statistical analysis of variability is provided to give a sense of how precise or un-precise these estimates are.

Specific Comments Relating to parameters used in the model:

1. The Dalles powerhouse survival estimate. The model uses 90% for the current case and 92% for aggressive cases. Recent NMFS survival studies (Dawley 2000) indicated a survival estimate of 80% for spring and 82% for summer migrants, respectively. To insure that the results are conservative these values should be used in the modeling.

If the current powerhouse survival is 80% to 82%, then the aggressive estimate also needs to reflect this lower number. The improvement for the aggressive analysis is based on improvements gained through the installation of Minimum Gap Runners (MGR's). However, improvements of the MGR's at Bonneville are uncertain. There was no statistically significant improvement, thus we question the 2% improvement that was assumed in the aggressive plan. Furthermore, no MGR installation is shown for the Dalles in the System Configuration Team's (SCT) Schedule, which currently extends into 2005. Thus the MGRs must begin to be installed after that time period. At most, one to two can be installed per year. Therefore, in five years at most only 10 would be installed at The Dalles, which would be less than half the powerhouse. So even if the MGR did show an improvement over current units (which is not the case given current studies), the full benefit would not be realized until after the period addressed by the opinion. This is not considered in modeling the aggressive case.

Further, at The Dalles, SIMPAS estimates indicate that the greatest improvement in dam passage survival (for spring chinook) will occur over "existing conditions" where survival jumps from 90.8% to 97.8% under an aggressive mix alternative. This represents a 7% improvement in dam passage survival. In turn, NMFS translates this dam survival gain from $(90.8 \times 0.983) = 0.8925$ under existing conditions to $(0.973 \times 0.983) = 0.956$ under the aggressive mix alternative. This improvement is assumed by increasing spillway survival to 98% by reducing spill from 64% to 40% (based upon 1998-1999 survival studies see above comments on The Dalles Spill studies), and by increasing sluiceway survival from 94 to 96%. Sluiceway survival is assumed to be improved by repositioning the outfall. These assumptions, however, do not comport with all of the field study results. For example, research results from 2000 studies indicates that substantially more migrants are sent through the turbines with the reduction of spill from 64% to 40%. The 2000 studies also indicate that spillway survival is approximately 94%, while turbine survival is only 80%. Using this data in the model, dam survival is 0.929, and overall project survival is only 0.913. This example illustrates how NMFS optimistically uses questionable data, plugs it into the SIMPAS model, and extrapolates it in the CRI to show that performance standards can be met, population growth rates can be met from meeting the performance standards and thus, the FCRPS can meet recovery levels under the RPA.

2. The raised spillway weirs (RSW) in the aggressive modeling case are assumed to have a spill efficiency ratio of roughly 3:1. This means that for each percent of flow spilled three percent of the juveniles are passed via the spill. No RSWs have been tested anywhere in the region so this assumed efficiency is complete speculation. NMFS had such speculations regarding the passage efficiency of the Lower Granite surface collector in the 1995-1998 FCRPS biological opinion, and NMFS delayed implementation of breaching based upon the hope that the technology would be successful. The structure, after an \$80 million cost investment and five years of study, is being removed as a failed experiment. To be realistic, conservative and generous, an RSW passage efficiency estimate of 2:1 would be more appropriate. This is a 100% improvement over most spillways, which are considered to be a 1:1 spill ratio.

3. There is an assumed 10% improvement in pool survival under the aggressive modeling case. Again, CRITFC believes that, without drawdown and/or significant flow augmentation (not found in the draft opinion) that this is an unrealistic, speculative assumption. The improvement is generated from an assumed reduced delay in dam forebays and improved predation control measures. Reductions in delay are assumed to come from spill through the RSWs, which are speculated to move fish past the project quicker and with less turbulence, which in turn, makes them less vulnerable to predation. This is based on the assumed benefits of an untested and uncertain passage technique. Further, in view of the millions of dollars already expended on the issue, CRITFC highly questions what additional measures can be accomplished to significantly reduce predation that have not already been implemented.

SIMPAS MODEL RESULT

CRITFC has reviewed the SIMPAS model runs and results, including NMFS' underlying assumptions and parameters. CRITFC does not agree with many of the assumptions and parameters.¹⁰ Many are based upon NMFS' "best professional judgment" instead of scientific data from relevant studies, which is available. CRITFC used this data and also adjusted certain NMFS modeling techniques (e.g. NMFS weighing average or high flow years disproportionately for the model flow parameter). CRITFC model assumptions and parameters are referenced in Attachment 1, Tables 1 and 2.

After review of the model parameters, CRITFC, using the SIMPAS model, conducted additional model runs to compare the results with those in the draft opinion. The analysis addresses the Base Case and an Aggressive Case. The "Base Case" reflects anticipated effects of the immediate actions (e.g. next year's actions) identified in the BiOp. The "Aggressive Case" generally reflects the anticipated effects of long term configuration changes (e.g. surface bypass systems with installation time frames ten years in the future).

NMFS Base Case:

These values reflect the actual SIMPAS calculations obtained from NMFS and used in the draft BiOp.

CRITFC Alternative 1:

Goal: Obtain corrected and more accurate survival estimates for both the draft opinion Base (Immediate) Condition, and the Aggressive (Long Term) Program simulations. Using the SIMPASS Model, staff calculated a corrected value for the NMFS BiOp existing conditions case for the current hydro-system. This is the estimated value NMFS should be using in their analysis instead of the value NMFS reports in their BiOp. The following paragraphs describe the modifications made by CRITFC to calculate "CRITFC alternative 1" values for the Base and Aggressive cases.

1. CRITFC Modification 1 to NMFS actions in the draft BiOp. The NMFS Base Case Parameters were adjusted by CRITFC to reflect the values in Tables 1 and 2 (below). Given time constraints, CRITFC did not have the ability to adjust all parameters. Spill efficiency and diel passage were not altered. Neither were the spill cap values. Spill cap values could not be adjusted due to model structural restrictions. For example, the model does not have the ability to incorporate flow and associated spill in time steps, thus, only one flow and associated spill level is available for spring and fall seasons. In reality, spill levels fluctuate throughout the year due to variations in flow and in-season spill management changes to accommodate spill waivers. River operations over the past several years have reduced spill volumes such that the spill targets are not met. Because the model is not capable of reflecting this real-time operation, the model overestimates spill levels and correspondingly overestimates dam survival levels.. In the available time for comments and

¹⁰ Many of the NMFS passage assumptions and parameters are critiqued in the CRITFC Comments on the October 1999 NMFS' White Paper *Passage of Juvenile and Adult Salmonids past Columbia and Snake River Dams* and CRITFC Comments on the September, 1999 NMFS White Paper, *Salmonid Travel Time and Survival Related to Flow Management in the Columbia River Basin*.

model review, CRITFC could not incorporate adjustments to correct for this model deficiency, which biases survival upward.

2. CRITFC Modification 2. CRITFC adjusted the model to calculate survival averages using a flow-weighted technique that equally distributes flow year classes (high, medium and low) according to an equal probability of occurrence. This was accomplished to remove biases in the NMFS flow parameter, since NMFS used only 1994-1999 flow years, and took the average of these years. All but one of these years (1994) are medium or high flow years. As described earlier, the results of the existing SIMPAS model are biased toward higher flow and higher project and reach survival than that which would occur by an equal probability that flow years could be high, medium or low. This bias is especially a concern for juvenile fall chinook because there is no reach-survival passage data for 1994, which was the only low flow year for the series .
3. CRITFC Modification 3. Only minor alternations were made to the Aggressive Program parameters. The alterations were made to NMFS parameters that CRITFC believed were speculative and overly optimistic. Two key areas were addressed. First, CRITFC did not believe that it was reasonable that The Dalles turbine survival would increase from 90 to 92% because it is not feasible that the entire powerhouse would be retrofitted with minimum gap runners by 2010. Second, CRITFC did not believe that it was reasonable to assume large increases in fish guidance efficiency for projects that already have extended intake screens. Both of these NMFS assumptions bias reach and project survival upward.

CRITFC Alternative 2

Goal: Determine the effect of using the *CRITFC 2000 River Operations Plan* in managing the hydrosystem. Key parameters of the *Plan* are previously described above in these comments. They include increased spill, shaping flows to meet a normative hydrograph, and significantly less passage through screen and transportation systems. *Plan* parameters can be implemented in a short time period. Using the SIMPASS Model, staff calculated a corrected value for the NMFS BiOp aggressive case. This is the estimated value NMFS should be using in their analysis instead of the value NMFS reports in their BiOp. Staff modified the Aggressive case to insure that the improvements were feasible and accounted for the most recent data. The following modifications were made to the SIMPAS model to calculate values for CRITFC alternative 2.

1. CRITFC Modification 1 to NMFS draft opinion. For the CRITFC alternative 2 to the Base Case, SIMPAS was returned to the actions (with the corrected values from CRITFC alternative 1, including appropriate flow weighting) used by NMFS in the draft opinion. Using the SIMPASS Model, staff calculated an estimate for improvement that can be realized through the use of increased spill and flow management consistent with the CRITFC 2000 River Operations Plan. This estimate is the potential improvements that can be achieved in the current hydro-system configuration with only operational changes. These alternations were based upon new data that was not available at the time the initial NMFS model runs were performed, and NMFS staff agreed that it was appropriate to use this new data. The spill volume parameters were altered to reflect the *CRITFC 2000 River Operations Plan*. The *Plan* calls for increased daytime spill and increases, where possible, in nighttime spill volumes.
2. CRITFC Modification 2. For the CRITFC alternative 2 to the NMFS' Aggressive case, using the SIMPASS Model, staff has calculated an estimate for improvement that can be realized through the

use of increased spill and flow management consistent with the CRITFC 2000 River Operations Plan, as well as suggested tribal structural improvements. This estimate is the potential improvements that can be achieved using the CRITFC Plan and the tribal structural improvements. This estimate depends on improvements to the spill program and installation of full flow surface bypass options. This option is to be implemented in a short (~5 years) time period, as opposed to the NMFS aggressive case, which will take 10 or more years to implement. Furthermore, staff has concerns with the feasibility of NMFS's estimates ability to achieve the values used in the aggressive case.

RESULTS:

Steelhead Base Case (Existing Condition):

	LWG Surv.	LGS Surv.	LMN Surv.	IHR Surv.	MCN Surv.	JDA Surv.	TDA Surv.	BON Surv.	Overall Surv.
NMFS draft opinion	88.63 %	90.37 %	90.53 %	90.84 %	%89.6 0	84.68 %	87.07 %	85.3%	40.13%
CRITFC Alter. 1	83.04 %	87.63 %	90.08 %	89.12 %	85.69 %	79.26 %	87.76 %	83.52 %	29.08%
CRITFC Alter. 2	84.36 %	89.04 %	90.69 %	89.12 %	85.82 %	79.56 %	87.53 %	84.00 %	30.48%

(Note Overall % Surv – Represent the Survival from LGR to BON.)

Steelhead Aggressive Case:

	LWG Surv.	LGS Surv.	LMN Surv.	IHR Surv.	MCN Surv.	JDA Surv.	TDA Surv.	BON Surv.	Overall Surv.
NMFS draft opinion	89.93 %	92.19 %	93.96 %	91.57 %	90.78 %	86.34 %	93.55 %	89.17 %	49.53%
CRITFC Alter. 1	86.44 %	89.92 %	92.64 %	90.26 %	88.79 %	82.25 %	91.19 %	88.64 %	38.37%
CRITFC Alter. 2	86.70 %	90.51 %	92.70 %	89.85 %	88.76 %	82.04 %	90.93 %	88.16 %	38.16%

(Note Overall % Surv – Represent the Survival from LGR to BON.)

Yearling (Spring) Chinook Base Case:

	LWG Surv.	LGS Surv.	LMN Surv.	IHR Surv.	MCN Surv.	JDA Surv.	TDA Surv.	BON Surv.	Overall Surv.
NMFS draft opinion	91.61 %	91.28 %	90.41 %	91.36 %	90.45 %	82.48 %	87.10 %	87.21 %	39.83%
CRITFC	87.76	86.83	90.43	91.11	88.09	80.175	88.59	86.36	33.92%

Alter. 1	%	%	%	%	%		%	%	
CRITFC	90.01	88.37	91.08	91.11	88.23	80.56	88.35	87.00	36.06%
Alter. 2	%	%	%	%	%	%	%	%	

(Note Overall % Surv – Represent the Survival from LGR to BON.

Yearling (Spring) Chinook Aggressive Case:

	LWG Surv.	LGS Surv.	LMN Surv.	IHR Surv.	MCN Surv.	JDA Surv.	TDA Surv.	BON Surv.	Overall Surv.
NMFS draft opinion	92.69 %	91.77 %	93.39 %	92.00 %	91.64 %	84.51 %	93.54 %	90.74 %	48.74%
CRITFC Alter. 1	91.55 %	89.67 %	92.82 %	91.70 %	90.95 %	82.97 %	92.05 %	90.82 %	44.08%
CRITFC Alter. 2	92.35 %	89.90 %	93.17 %	91.70 %	90.95 %	82.91 %	92.05 %	90.88 %	44.7545 %

(Note Overall % Surv – Represent the Survival from LGR to BON.

Sub-Yearling (Fall) Chinook Base Case:

	LWG Surv.	LGS Surv.	LMN Surv.	IHR Surv.	MCN Surv.	JDA Surv.	TDA Surv.	BON Surv.	Overall Surv.
NMFS draft opinion	56.49 %	75.81 %	80.64 %	83.29 %	77.05 %	61.53 %	78.48 %	73.62 %	10.45%
CRITFC Alter. 1	54.87 %	73.76 %	77.84 %	84.07 %	75.16 %	62.74 %	81.10 %	75.44 %	7.64%
CRITFC Alter. 2	57.83 %	77.74 %	82.29 %	84.07 %	76.54 %	63.40 %	81.10 %	76.32 %	9.34%

(Note Overall % Surv – Represent the Survival from LGR to BON.

Sub-Yearling (Fall) Chinook Aggressive Case:

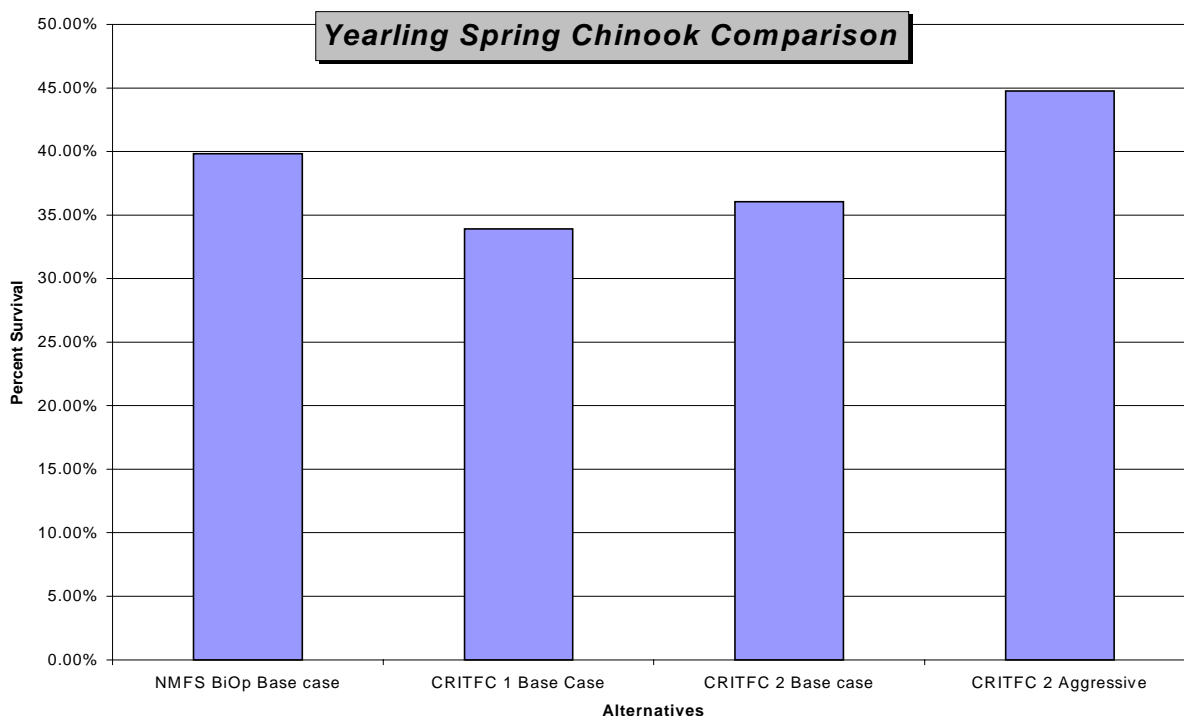
	LWG Surv.	LGS Surv.	LMN Surv.	IHR Surv.	MCN Surv.	JDA Surv.	TDA Surv.	BON Surv.	Overall Surv.
NMFS draft opinion	64.39 %	77.65 %	82.14 %	84.74 %	79.02 %	66.08 %	86.87 %	78.97 %	15.56%
CRITFC Alter. 1	64.37 %	75.69 %	79.59 %	85.48 %	79.66 %	67.84 %	86.41 %	81.27 %	12.58%
CRITFC Alter. 2	66.33 %	80.59 %	84.29 %	86.11 %	81.06 %	67.60 %	86.34 %	81.12 %	14.89%

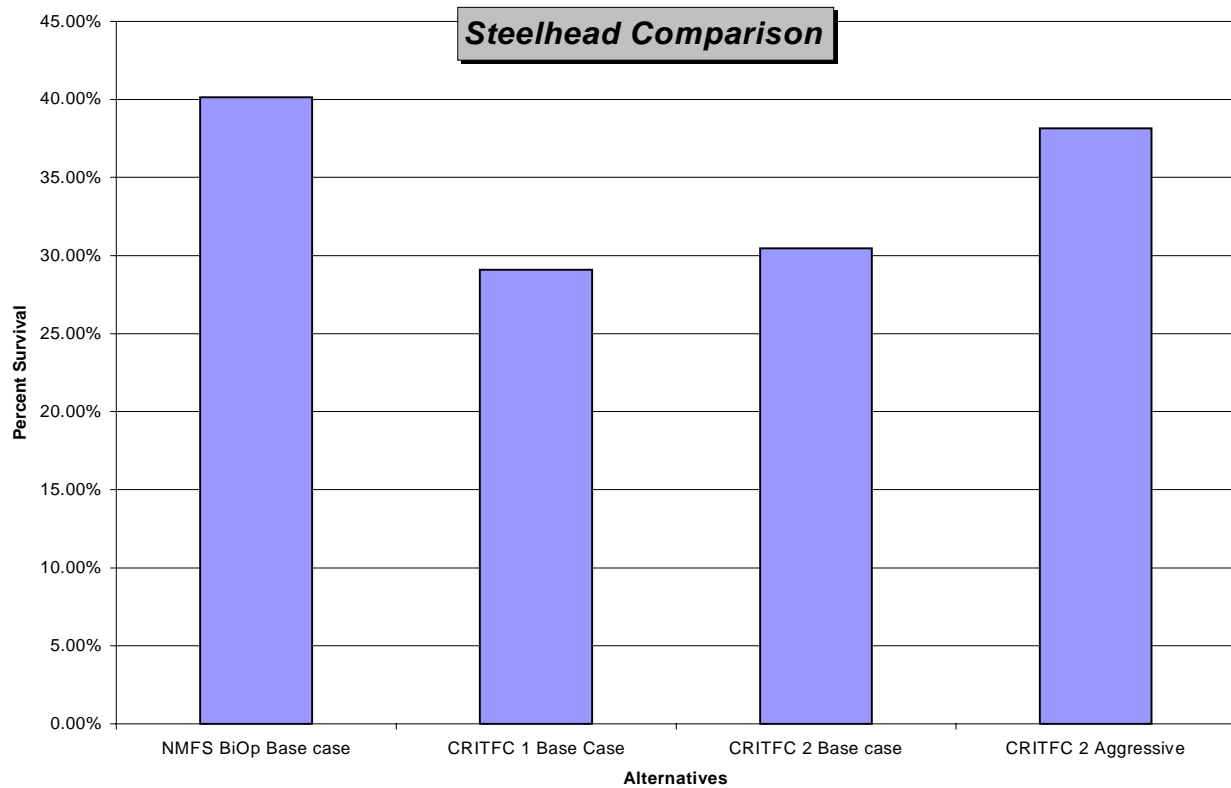
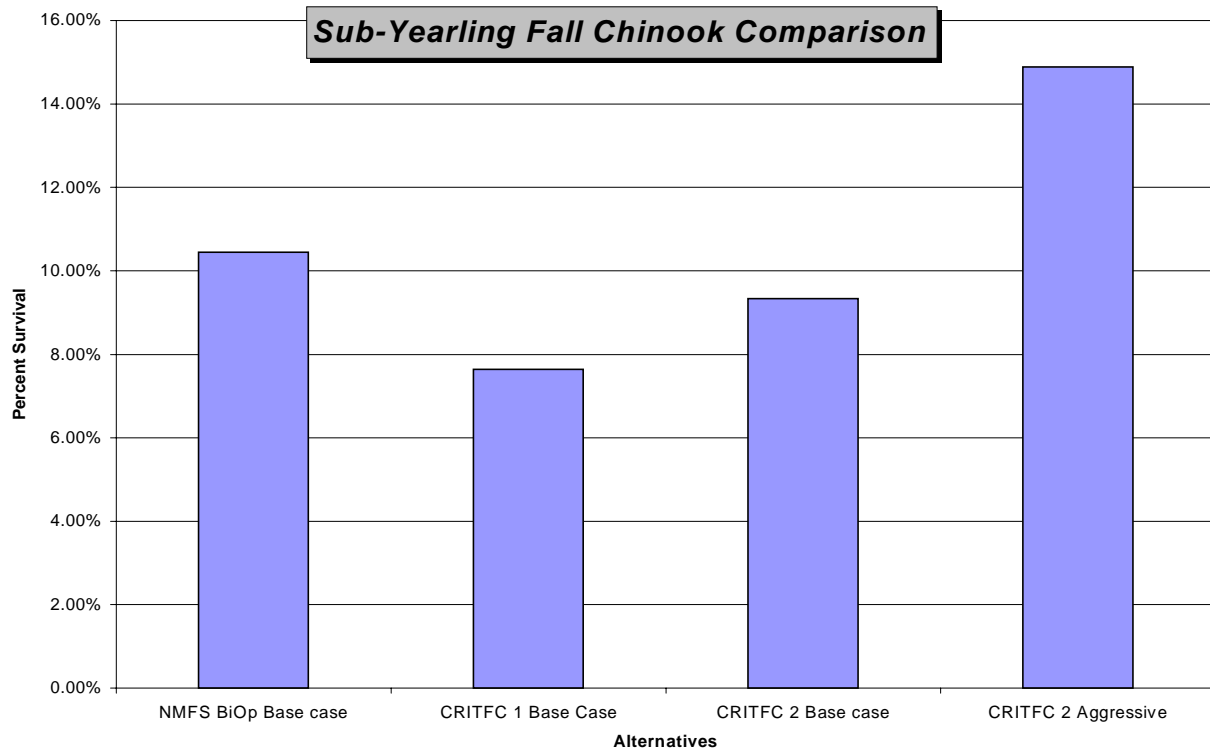
(Note Overall % Surv – Represent the Survival from LGR to BON.

Conclusions

After inserting more conservative and reasonable assumptions, using available scientific analyses and feasibility, it appears that the NMFS Base Case and Aggressive Program both substantially overestimated survival estimates at each project and through the FCRPS migration corridor. If the CRITFC model parameters and resulting survival estimates are considered, it is apparent that 1) reach and project survival as modeled by NMFS is far less than NMFS' current estimates and 2) the hydrosystem will have to make significantly more improvements to achieve its objectives. This will mean that more aggressive measures, such as draw downs and breaching will be needed to meet FCRPS performance standards and population growth rates. Again, it must be stressed that the SIMPAS model fails to incorporate the flow-survival relationship, a life cycle, spawner to spawner approach, which accounts for among other things, the effect of delayed mortality.

While the CRITFC Alternative 2 results do not show the magnitude of survival improvement that NMFS model runs achieved with their speculative assumptions and biases, the CRITFC Alternative 2 results do show a marked survival improvement under both conditions. SIMPAS model simulations indicate that if the *CRITFC 2000 River Operations Plan* was adopted under current conditions, a measurable survival improvement is apparent, with the possible exception of fall chinook. This is likely because the SIMPAS model assumes great benefits for juvenile transportation because delayed mortality is not accounted for in the model. A greater survival benefit is realized when additional improvements are included as model parameters, such as full flow surface bypass. Model restrictions prevent a true assessment of the CRITFC Alternative 2 Aggressive simulation, because the model cannot accommodate benefits, such as increased pool survival, related to improved flows and a normative hydrograph.





Attachment 1

Table 1. CRITFC Juvenile Subyearling Chinook Passage Parameter Estimates For Dam Passage

Project	Spill Eff	Spill Cap (kcfs)	FGE	Screen Bypass Survival	Turbine Survival	Spillway Survival	Diel Pass (%day v. night)
LWG	1 to 1	45	42 (4)	92 (6)	89 (5)	98	68
LG	1 to 1	35	42 (4)	92 (6)	89 (5)	98	68
LM	1 to 1	40	35.2(5)	92 (6)	89 (5)	98	83
IH	1.45 to 1 (3)	75	54	na	89 (5)	98	50
McNary	1 to 1	135	67(5)	92 (6)	89 (5)	98	64 (1)(2)
JD	1 to 1	85k /or 60%	35 (5)	92 (6)	89 (5)	98	50
TDA	1.2 to 1	40%	3	na	89 (5)	93	50
Bon 1	1 to 1	120	24(5)	92 (6)	90(5)	100 (5)	50
Bon 2	1 to 1		32.5(5)	92 (6)	94(5)	100 (5)	
Spill efficiency from NMFS 2000 draft BO Spill caps from 2000 TMT water management plan 1 Biosonics 1997 2 Biosonics 1998 3 Eppard et al (1999) 4 Venditti et al. (1998) average of three years FGE 5 Whitney et al. (1997) 6 Chapman and Witty (1993) from Ledgerwood et al. (1990)							

Table 2. CRITFC Juvenile Yearling Chinook and Steelhead Passage Parameter Estimates For Dam Passage

Project	Spill Eff	Spill Cap (kcfs)	FGE	Screen Bypass Survival	Turbine Survival	Spillway Survival	Diel Pass (%day v. night)
LWG	1 to 1	45	66*	94.6 (4)	83.1(8)	98	65 (1)
LG	1 to 1	35	77.3*	95 (5)	92	98	65 (1)
LM	1 to 1	40	69*	95.8 (6)	92	98	65 (1)
IH	1.45 to 1 (3)	75	54	na	90 (8)	98	50
McNary	1 to 1	135	88*	95 (5)	89 (8)	98	50
JD	1 to 1	85/or 60%	72*	95.8 (7)	87 (8)	98	56 (2)
TDA	1.2 to 1	40	3	na	80(9)	95 (9)	50
Bon 1	1 to 1	120	39	90	90	100 (5)	50
Bon 2	1 to 1		48	95.8 (7)	97.7 (8)	100 (5)	
Spill efficiency from NMFS 2000 draft except IH (Eppard et al. 1999) BO Spill caps from 2000 TMT water management plan * FGE assumptions differing from NMFS 2000 draft BO are from Whitney et al. (1997) 1 Johnson et al. 1999 2 Biosonics 1997 and 1998 3 Eppard et al (1999) 4 Chapman et al. (1991) 5 Muir et al. (1998) 6 Hockersmith et al. (2000) 7 Hockersmith et al. (2000) and best estimate for standard length screens 8 Whitney et al. (1997) 9 Dawley et al. (2000)							

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Comments on Appendix D

Development of A Water Quality Plan for the Columbia River Mainstem: A Federal Agency Proposal

From CRITFC's perspective, NMFS and the Action Agencies' management of the ESA remains contrary to the provisions of the Clean Water Act. The draft RPA continues the practice called for by the previous FCRPS biological opinions which requires holding of juvenile fall Chinook in screen bypass and transportation facilities at McNary and Lower Snake dams in temperatures exceeding the water quality standard. The beneficial use under the CWA, the salmon, would be better served if they were left in the river via spill, and allowed access to lower ambient river temperatures that are available at depth in the reservoirs.

This plan lacks firm dates or even a specified schedule that requires the Action Agencies to make significant steps toward meeting the Clean Water Act for dissolved gas and temperature. The plan lacks addressing compliance for other important parameters under the Act, including dissolved oxygen requirements, and point source pollutants, including toxics.

The plan calls for more process and studies, and little actions to bring the FCRPS into compliance with dissolved gas and temperature standards. CRITFC recommends that this plan and the draft RPA be modified as follows:

- **Monitoring and evaluation.** In the comments above, specific recommendations for a systemwide, tri-level dissolved gas and temperature monitoring system are described. This system should be established in the entire Columbia and Snake Rivers by March, 2002.
- Specifically, flood control should be modified at Lake Roosevelt to allow for selective withdrawal of cooler water at depth and use of drumgates that reduce total dissolved gas from Grand Coulee as suggested by the Corps Environmental Assessment for the Chief Joseph Spillway Deflectors (2000). This operation would benefit the entire Mid-Columbia Reach.
- Firm dates for the stepwise reduction of total dissolved gas and temperature to meet the standards must be established, with the standards met by 2012. Structural and operational measures must be given funding priority by the Action Agencies over installation of screen and transportation systems and estuary research and must be implemented in a manner to reduce violations and meet the standards. The following projects and associated completion timelines should be met:

**Projects and Completion Dates to Bring the FCRPS
into Compliance
With the Clean Water Act**

Gas abatement/add endbay deflectors	MCN	2004
Gas abatement-extended/improved deflectors	MCN	2007
Gas abat.-raised or stepped basin/side channels	MCN	2011
Adult fishway temperature control/add pumps	MCN	2003
Fishway temperature control structures	MCN	2008
Gas abatement-extended/improved deflectors	JDA	2007
Gas abat.- raised/stepped basin/side channels	JDA	2011
Fish ladder temp control/add pumps	JDA	2004
Fishway temperature control structures	JDA	2008
Gas abatement-extended/improved deflectors	TDA	2004
Gas abatement-stepped basin/side channels	TDA	2011
Fish ladder temperature control/pumps	TDA	2004
Fishway temperature control structures	TDA	2009
Gas abatement-extended/improved deflectors	BON	2007
Fast Track- endbay deflectors	BON	2002
Gas abat./raised or stepped basin/side channels	BON	2011
Fishway temperature control/pumps)	BON	2005
Fishway temperature control structures	BON	2009
Chief Joseph temp.control/multiport outlet	CHJ	2011
Chief Joseph Gas abatement-extended/improved deflectors	CHJ	2004
Chief Joseph gas abatement.-stepped basin/side channels	CHJ	2011

Dworshak Gas-raised/stepped tailrace/outlet/deflector	DWK	2011
Dworshak temp control/independent hatchery supply	DWK	2002
Libby gas abatement: 3 turbines	LIB	2009
Grand Coulee temperature control-low level outlets	GCL	2011
Grand Coulee Gas (Deflectors/Mid Level Cov)	GCL	2007
G.Coul.Gas:stepped basin/side chan./widen river channel	GCL	2011

Comments on Appendix E

Risk Assessment for the Spill Program Described in the 2000 Draft Biological Opinion

CRITFC concurs with the assessment's conclusion:

“[R]ecent research and biological monitoring results support the findings of the 1995 report which predicted that TDG in the 120 to 125% range coupled with vertical distribution fish passage information that indicate most fish migrate at depths providing some gas compensation, would not cause juvenile or adult salmon mortalities that would exceed the expected benefits of passage”.

Thus, the RPA should be modified to allow spill in order to achieve a 90% fish passage efficiency objective in manner consistent with the Clean Water Act. Appendix E in the draft opinion supports this change, as does the results of the last five years of in-river research. Flexibility to allow spill an an interim measure will best protect salmon and steelhead habitat, one of the beneficial uses of these waterbodies, pending the timely implementation of measures designed to ensure compliance with the Clean Water Act at these facilities.

A key deficiency of the risk assessment is that evaluation of the potential survival benefits of reduced screen bypass passage compared to increased juvenile anadromous fish passage through spill was not addressed. The Risk Assessment should be modified to include this evaluation, in full consultation with the tribes, the state fishery agencies, and the USFWS. The revised risk assessment should be included in the final 2000 FCRPS biological opinion.

Increasing spill at selected projects could provide significant survival benefits for all ESU's under the draft opinion. The RPA should prioritize gas abatement structural and operational measures to achieve the state and federal dissolved gas standard of 110%. Further, the RPA should mandate that these structures be expediently installed or implemented. These actions should be given among highest priority for implemenation by the Action Agencies. For the near term, CRITFC recommends that the FCRPS achieve an interim standard of 125% total gas pressure, 365 days a year at all flows less that the 10 year 7 day average flood flow.

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